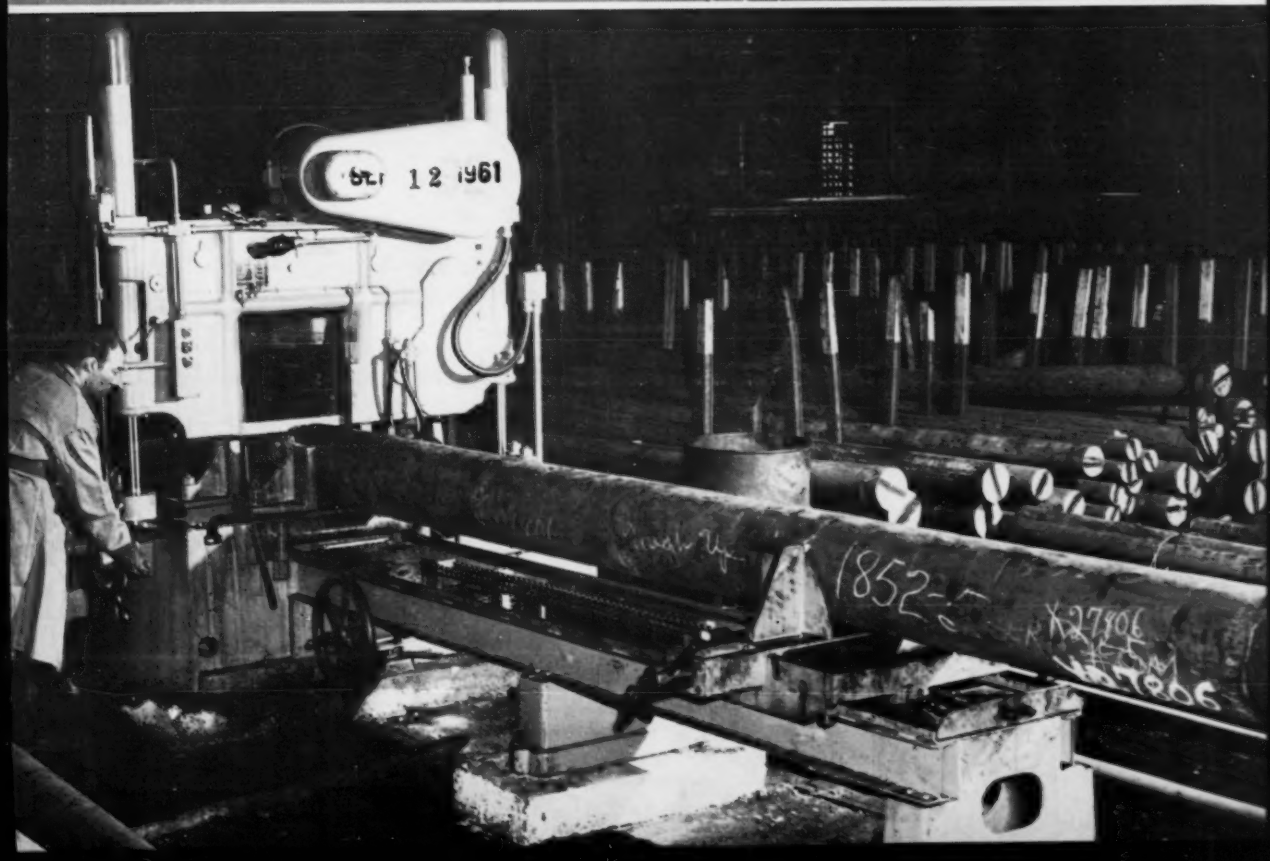
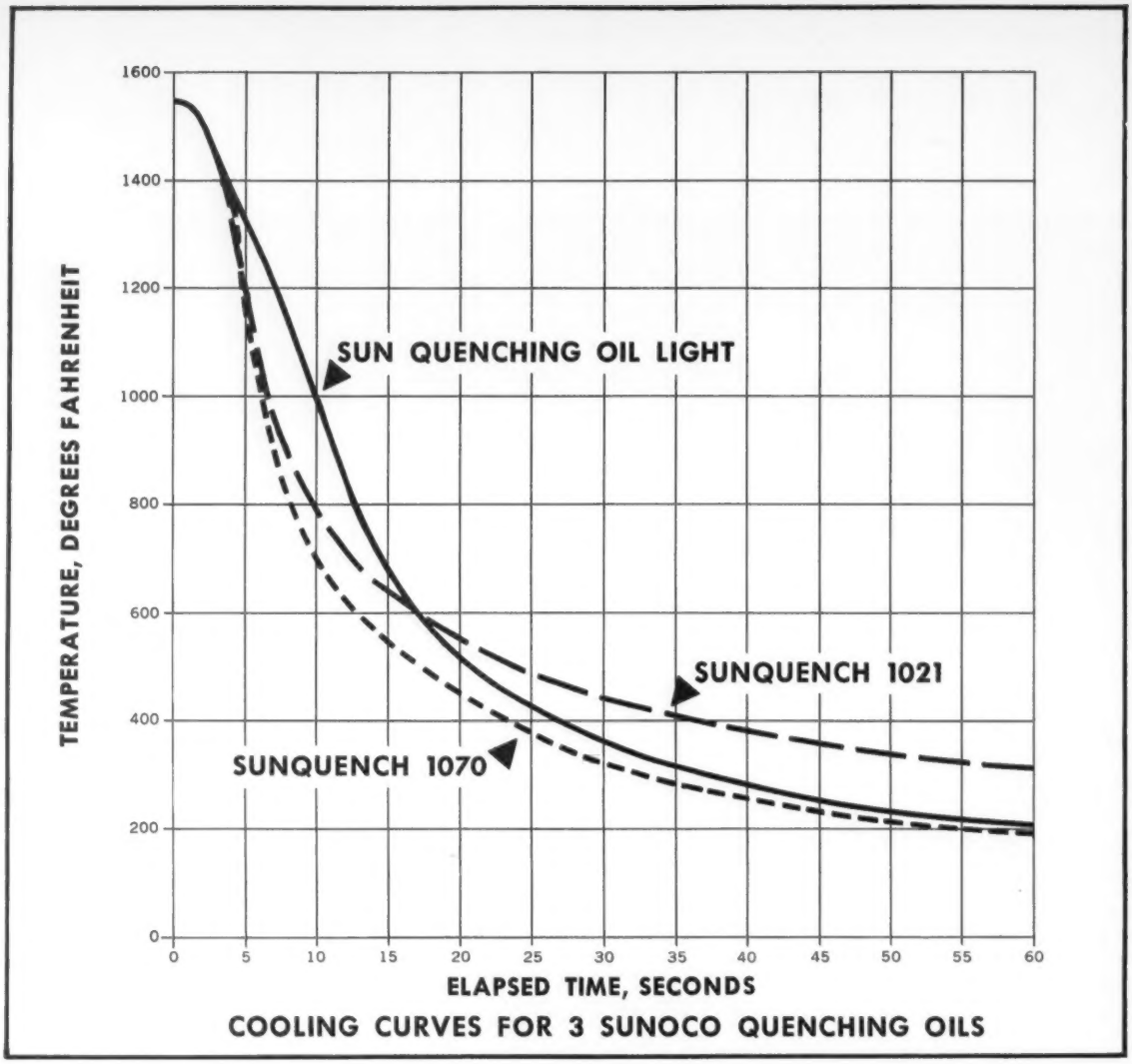
Metal Treating

AUGUST
SEPTEMBER
1961

THE ONLY MAGAZINE DEVOTED EXCLUSIVELY TO THE HEAT TREATING INDUSTRY





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From Sun's full line of quenching oils you can get *exactly* the quality you need to do the job right. There's no need to shop around, or to deal with two or three suppliers. If you quench with oil, Sun has the product. See your Sunoco man . . . or write to Sun Oil Company, Philadelphia 3, Pa., Dept. MR-8. In Canada: Sun Oil Company Limited, Toronto and Montreal.

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For further information circle No. 1

Metal Treating

THE ONLY MAGAZINE DEVOTED EXCLUSIVELY TO THE HEAT TREATING INDUSTRY

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FEATURES

DEPARTMENTS

• • •

Indexed in Engineering Index

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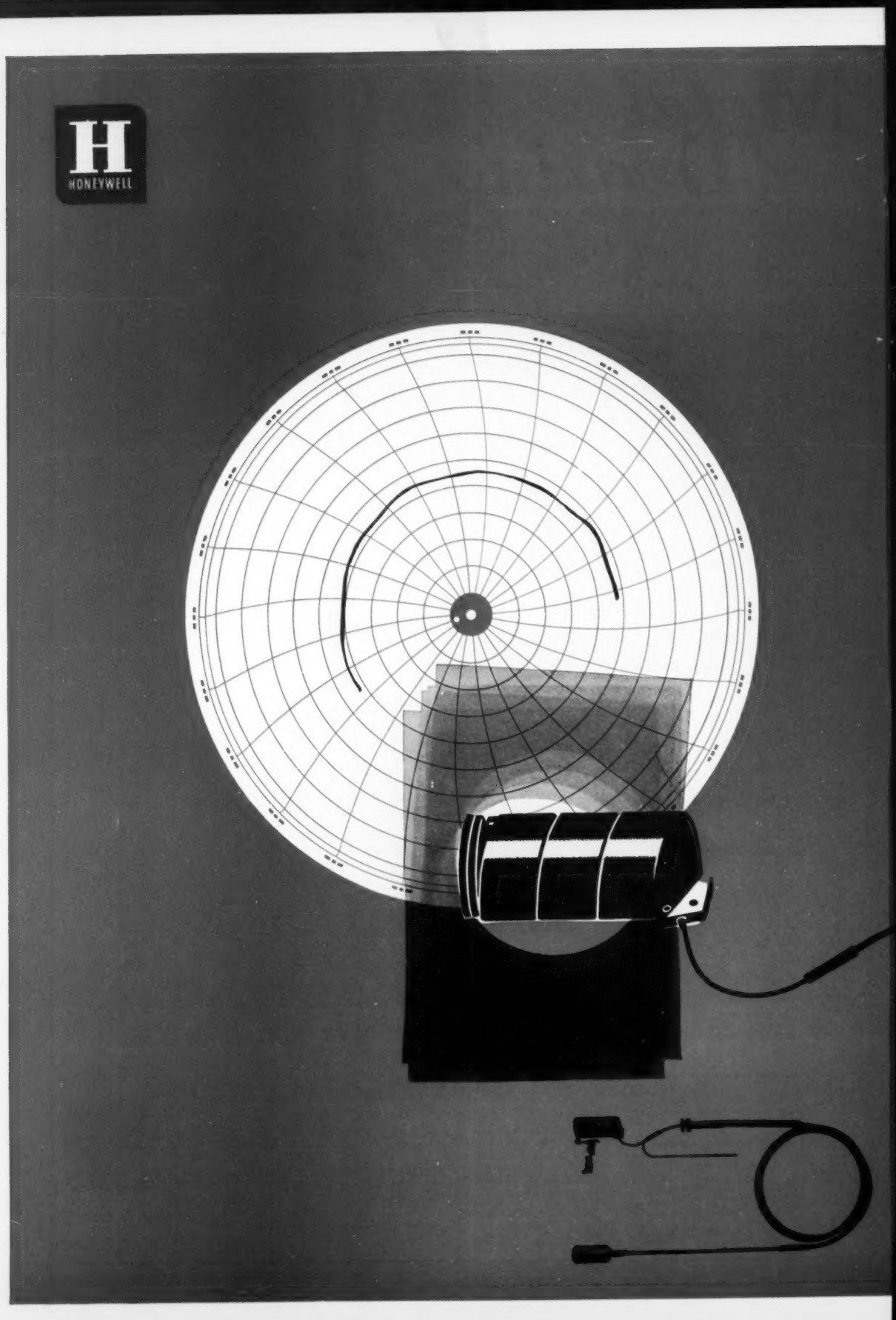
About Our Cover

For the production of this large crankshaft, the specifications of steel type, bar size and after-machining heat treatment—are all provided by the heat treater, Benedict-Miller, Inc., Lyndhurst, N. J. The procedure is fully described in "The Anatomy of a Specification" on page 10.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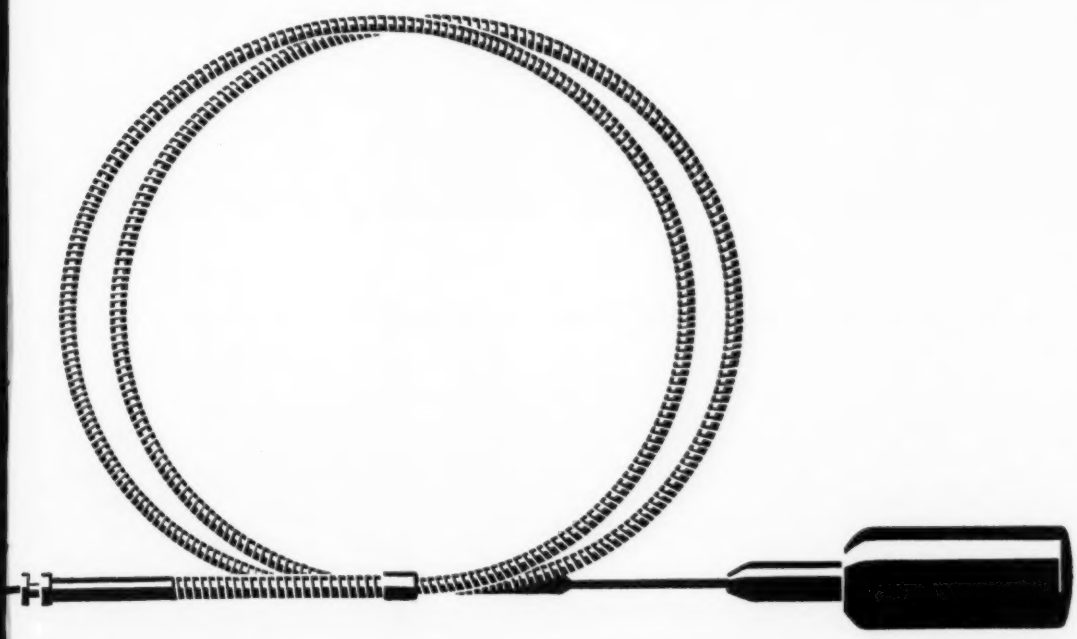

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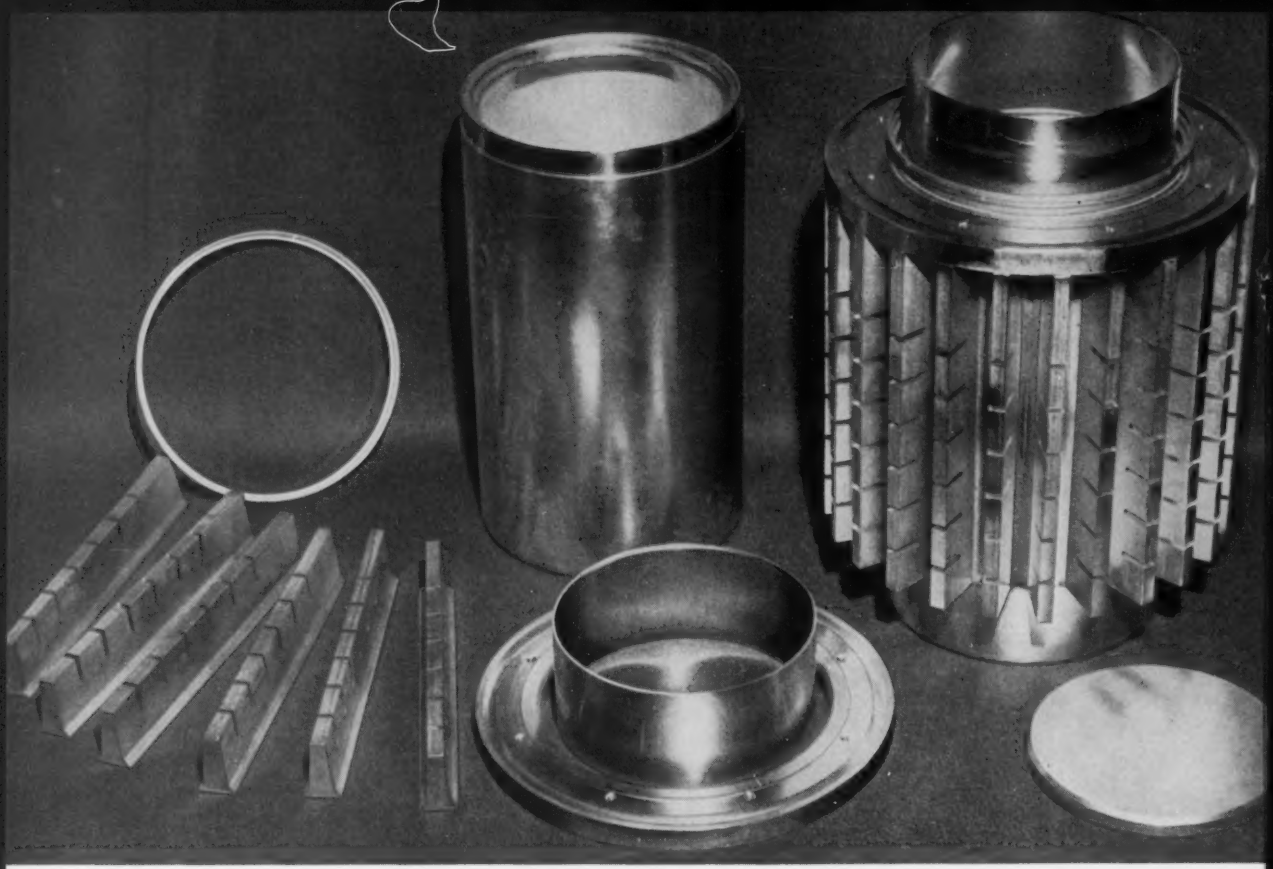

How to braze 28 parts of one assembly at one time

The objects shown above are the individual parts and the final brazed assembly of a solid copper, vapor-cooled anode used in a 400 kw continuous output triode. It's produced by the Machlett Laboratories, Springdale, Conn. There are 28 parts in all and the assembled unit weighs 85 lbs. A total of 51 areas and 20 feet of surface must be brazed in one operation. Strong, uniform, vacuum-tight joints are essential.

A Harper pusher-type box furnace equipped with vertical GLOBAR® silicon carbide electric heating elements does the job. Brazing is done in a hydrogen atmosphere protected by purging chambers using nitrogen and hydrogen. Operation is continuous—24 hours a day.

GLOBAR elements make possible the precise control—at 2200 F—necessary for this critical operation. They offer the advantage of clean heat, independent of the atmosphere. The rod type elements simplify furnace design. Maintenance requirements are small—furnace refractory has been changed only once in 4 years, indicating the mild conditions to which brick is subjected with this type of heating. Heat loss is so low that working areas are located immediately adjacent to the furnace.

Why not investigate the advantages of GLOBAR electric heating for your brazing or heat-treating job? Consult your furnace builder or write to Refractories Division, Globar Plant, Dept. **MT-81**, The Carborundum Co., Niagara Falls, N. Y.

For precise, economical electric heating

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For further information circle No. 3

J. WALTER REX tells why he chose Lindberg equipment for his new Florida plant

QUOTE from Mr. Rex

"When we designed our new plant, Rex of Florida, Inc., we made sure we could provide the Florida metal working industry with complete heat treating services. After carefully surveying the industrial activities we would serve we knew we would be called upon to offer scientifically controlled, high quality heat treating for a variety of metals, both ferrous and non-ferrous, and an unusual diversity of sizes, shapes and weights. Our long experience with Lindberg furnaces and atmosphere controls assured us that we could depend on Lindberg equipment to help us meet most efficiently the widely varying demands of our Florida customers."

J. Walter Rex, President, Rex of Florida, Inc., Fort Lauderdale, with Lindberg high temperature, all-purpose furnace, one of six Lindberg units specified for this new plant. Mr. Rex, also President, J. W. Rex Company, Lansdale, Penna., is recognized as one of the foremost metal working authorities and his commercial heat treating operations are among the largest and most important in the country, particularly in treating components for rockets and missiles.

Latest Rex purchase from Lindberg—new vacuum furnace for Lansdale, Penna., plant

Mr. Rex's confidence in the ability of Lindberg equipment to meet the most exacting commercial heat treating requirements is based on the years of efficient and dependable service rendered by Lindberg units in his commercial heat treating operations. He has been a Lindberg customer for nearly 20 years. We're glad that he has found our equipment so satisfactory. We're very well satisfied with Mr. Rex as a customer, too. Altogether, including the units for Rex of Florida, Inc., he has purchased 34 Lindberg units over the years.

Lindberg offers the most complete line of fuel-fired and electric furnaces and equipment for heat treating ferrous and non-ferrous metals available to industry. If you have any problem in heat treating, get your local Lindberg representative's help now. You can depend on his experience and Lindberg's engineering and design know-how to provide exactly the right equipment for your need. And it's easy, too! Just call your Lindberg Field Engineer (he's listed in your classified phone book) or write us direct. Heat Treating Furnace Division, Lindberg Engineering Company, 2466 West Hubbard Street, Chicago 12, Illinois.

Los Angeles plant: 11937 S. Regentview Avenue, Downey, California. In Canada: Birlefco-Lindberg Ltd., 15 Pelham Ave., Toronto 9, Ont. Also, Lindberg plants in Argentina, Australia, England, France, Italy, Japan, Spain, Switzerland and West Germany.

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For further information circle No. 4

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(Use this check-list)

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   Solid-state. Free from warm-up, tuning and complicated circuitry.
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   Indicated on mirrored anti-parallax scale.
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   Indicate both heating and cooling.
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   In every instrument at no extra charge. Shuts off heat if thermocouple breaks or burns out.
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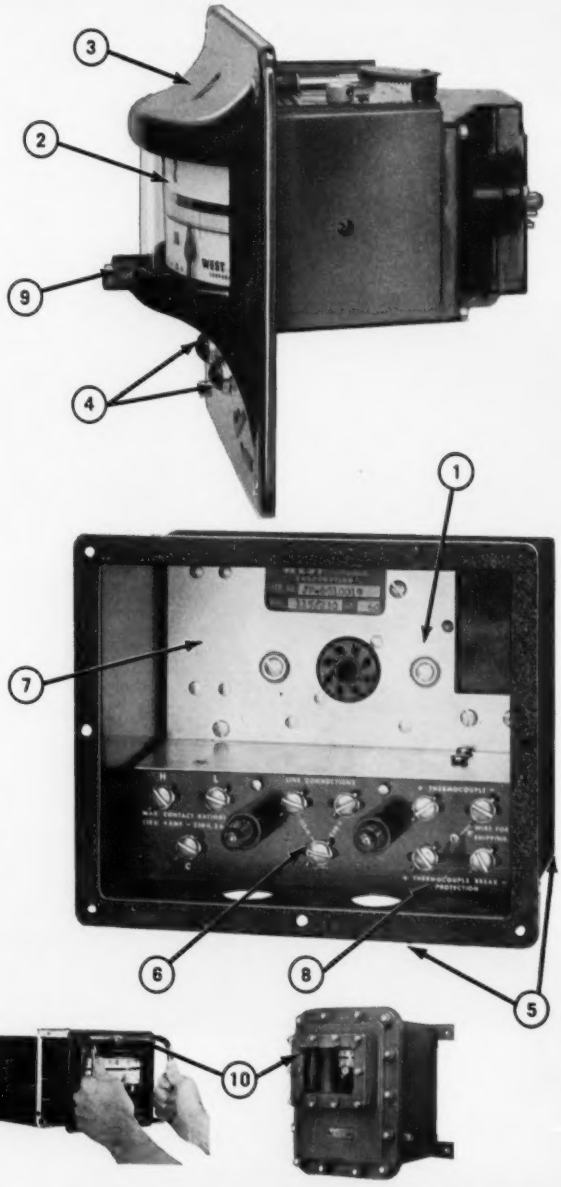

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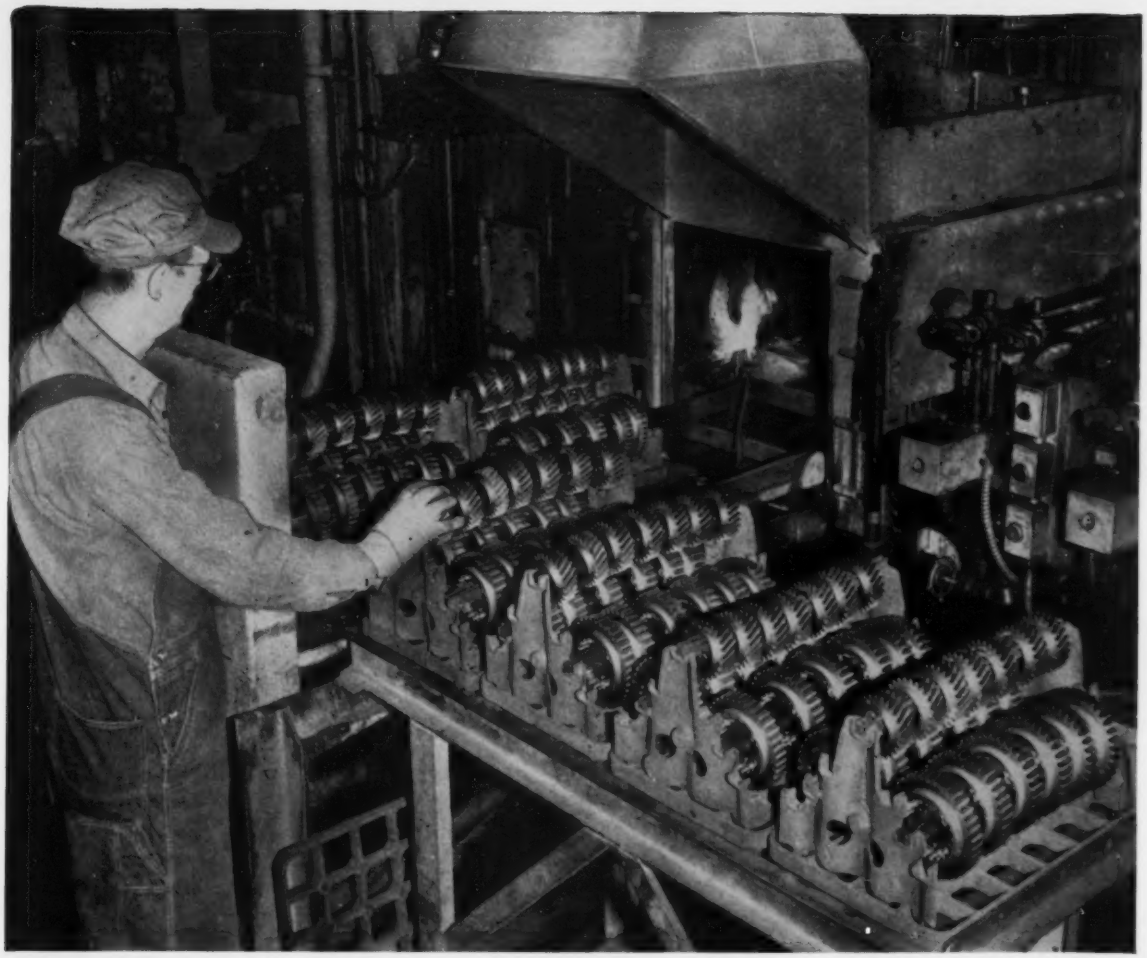

Cast high-nickel alloy trays and loading fixtures in mass carburizing system handle hot work through treatment. Other high-nickel alloy castings in this furnace include radiant tubes, hearth plates, nails, bracket keys, guides and elevators.

In cycle after cycle...

Cast high-nickel alloy furnace trays withstand 1700°F carburizing atmospheres

Resistance to carburization and thermal shock . . . high-temperature strength and castability make high-nickel alloys ideal for work trays, loading fixtures and other furnace parts.

Truck gears and other parts are mass treated in five carburizing furnaces like the one shown above at a well-known automotive plant.

In cycle after cycle, cast Type HT* high-nickel alloy work trays are used to carry the gears through a carburizing atmosphere of 1650 to 1700°F, through a 400°F oil quench and final cooling at room temperature. Type HT alloy has the hot strength to handle heavy loads and it easily withstands the thermal shocks of this three-stage heat treating cycle.

Type HT alloy is one of four whose high nickel content – over 33% – puts them in a class by themselves for resistance to sustained high temperatures and carburizing furnace atmosphere. You'll do well to specify these high-nickel alloys for your heat treating furnaces.

To help you select the best possible alloy, we offer the new 64-page booklet, "Heat Resistant Castings, Corrosion Resistant Castings...Their Engineering Properties and Applications." You'll find it useful when considering such design factors as sizes, shapes, atmospheres, load or cycling requirements. A post card today will bring you your free copy.

*Alloy Casting Institute designation

THE INTERNATIONAL NICKEL COMPANY, INC.

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NICKEL MAKES ALLOYS PERFORM BETTER LONGER

"Excellent Results Have Proved the Value and Versatility of Park's Non-Burning Carburizing Compounds"

Says L. A. Lindberg

President, Lindberg Steel Treating Co.
Chicago — Rochester — St. Louis
Los Angeles

"We have had excellent results with this Non-Burning Carburizing Compound for many years. For example, the pinion gear shaft that Milt Vandenberg is looking over has a heat treat specification of .040-.050" case depth and Rockwell 59-62 "C" Scale hardness.

"We process production quantities of these shafts in a two row, automatically controlled, pusher-type furnace using Park's Non-Burning (grade W) Carburizing Compound. The compound supports the parts during carburizing so that distortion is controlled and straightening operations are minimized. Tooth form and lead angle of the gear remain within the allowable tolerance and case depth is very accurately controlled.

"The value and versatility of this operation for such parts as well as for low-cost production items has been proved to us over the years. We have learned to depend on Park for uniformity and for service!"

Park NON-BURNING CARBURIZING COMPOUND is available in sizes No. 3, 6, and 8, and in two grades: "B" and "W". The latter grade is designed to minimize the possibility of copper migration on copper plated work. All sizes and grades are manufactured by coking a special quality coal in the presence of the energizing chemicals. This process produces a homogeneous compound and insures uniform carburizing activity even though usage reduces the material to pinhead size. Shrinkage rates are low and carburizing activity can be maintained indefinitely with addition ratios of as low as 1 to 10.

NON-BURNING is the quality carburizing compound that is economical to use. In addition to its uniformity and low replenishment requirement, it does not burn after removal from the furnace. NON-BURNING is especially suitable for carburizing alloy steel parts such as gears which are direct quenched or reheated. Send for the free, informative technical bulletin B-1, "Pack Carburizing of Steel in Solid Compounds".

● ● ●

Woodside Rapid Carburizers (Non-Burning—Charcoal-Coke-Specification) ● Park-Kase Liquid Carburizers ● Quenching and Tempering Oils ● Cyanide Mixtures ● Neutral Salt Baths ● High Speed Steel Hardening Salts ● Iso-Thermal Quenching and Tempering Salts ● Protective Coatings (No-Carb—No-Kase—No-Scale—No-Tride) ● Carbon Products (Charcoal-Crushed Coke-Pitch Coke-Lead Pot Carbon) ● Kold Grip Polishing Wheel Cement ● Par-Kem Metal Cleaners ● Cutting and Grinding Compounds (Kem-Cut—Kem-Grind—Blue Ice)

Park

PARK CHEMICAL COMPANY ● **8074 Military Ave. Detroit 4, Mich.**

For further information circle No. 6

Bright and clean—these steel parts have just come from a Voluta 921 quench bath.

BULLETIN:

Shell tells how new Voluta 921 cuts quench time, fights surface-spoiling spots and stains

Shell Research has developed a quench oil with a unique combination of properties: it cools quickly and assures a bright surface.

Read how Shell Voluta® 921 Quenching Oil can help eliminate staining problems, reduce rejects, and give you better brightness outside, better hardness inside.

SHELL's new Voluta 921 is a premium quench oil that helps assure metal surface brightness and maximum hardness without warping, cracking or distortion.

Brightness or hardness?

In the past, quench oils have been able to provide either "good looks" or toughness.

New Voluta 921 quenching oil gives both—and with remarkable speed.

How does Shell's Voluta 921 deliver these *two* benefits while most other quench oils can supply only one?

New formula does it

The high level of surface brightness comes from a special formula developed and perfected at Shell's research laboratory in Wood River, Illinois.

The very rapid quenching qualities of Voluta 921 come from the same advanced formula *and* from Shell's selected base oil stocks.

When the work emerges from a Voluta 921 bath, it is bright and clean. Hardness will be deep and uniform.

Proved in quality shops

Some of the most impressive facts regarding Voluta 921 came from Commercial Metal Treating, Inc., of Bridgeport, Connecticut.

Here the new oil was use-tested for nine months on everything from top-secret military parts to high-finish belt buckles.

It helped eliminate rejects caused by spotting and staining. It produced uniformly excellent results throughout the shop. Its high resistance to oxidation and sludging prolonged the usable life of the oil.

Commercial Metal Treating's President, Mr. Michael Kober, reports that his plant has *standardized on Voluta 921—uses nothing else.*

Shell's Voluta 921 can help improve metal hardness and heat-treating efficiency in your plant, too.

Call your Shell Representative

Ask your Shell Industrial Products Representative for all the facts on new Voluta Oil 921. Or write: Shell Oil Company, 50 West 50th Street, New York 20, N.Y.

SHELL

A BULLETIN FROM SHELL
—where 1,997 scientists are working to provide better products for industry

The Anatomy of A Specification

JOHN M. KELSO
Metallurgical Engineer
Benedict-Miller, Inc.
Lindhurst, New Jersey

Editor's Note: The cover photo of this issue provides an example of the development of a complete specification from material to finished produce.

TWO DIFFERENT PARTS are delivered to a heat treating facility for processing. A scrutiny of the purchase order accompanying each reveals the following:

One states: *material to be annealed to maximum hardness,* while the other refers to an engineering drawing referencing and is attached to a six page heat treat instruction including the material type by specification number, the type furnace and atmosphere to be employed, the temperatures for preheat and austenitizing, the quenching medium to be employed, definite times and temperatures for the tempering operation, the hardness range required, the hardness scale to be used, and specific areas for hardness checking.

Which part has the better chance for survival in the heat treating shop? The first, which specified only: *Anneal to maximum hardness.* If you pose the question, "which part has the better chance of incorporating the physical properties designed for an in-process operation or a specific end use?" the answer will be the latter. The one incorporating the multitude of instructions. The instrument which spells the difference is the heat treating specification.

First, let us establish that the existence of the heat treating specification is far more than desirable; it is essential. It is essential to the purchaser in that it defines *precisely* the physical characteristics and conditions of his end product. Equally important, it offers him a great measure of protection if his part to be subjected to heat treatment fails to meet the requirements spelled out. As a further aid, it gives him an insight as to the ability of the heat treater to meet the requirements accurately and consistently.

Care must be exercised in the preparation of a heat treat specification to insure the nature of the end product and at the same time provide the heat treater with his share of latitude in order to cope with what is referred to as heat characteristics—variations which can cause material to depart from the so called "typical" or "normal".

The heat treater is given the opportunity to see whether he can meet the requirements of the specification. He may be limited as to facilities or may lack certain pieces of inspection equipment. Absence of either would not allow him to process the part satisfactorily. Alternate procedures or tests are sometimes acceptable if all parties concerned are able to reach an understanding. Such negotiations are best done before any parts are processed, rather than after any possible damage has occurred.

The requirements of a heat treating specification can be placed in three major categories:

1. Those factors describing the nature, condition, and treatment of the material prior to the heat treating operation.

2. Those factors pertaining to the heat treat operation itself.

3. Those factors describing the conditions and characteristics of the material subsequent to heat treatment.

Under the first category the following steps must be taken to insure adherence to proper procedures.

(a) *Material identification must be made known.* If only one material analysis is under consideration, this simplifies those sections of the specification which have to do with actual times and temperatures. If, however, several analyses of a type, such as low alloy carburizing grade steels, are included in one specification, provision must be made for differences in such things as core hardness, quenching temperatures, tempering times and temperatures, and intermediate machining operations. In general, less confusion and chance of misinterpretation will result if the heat treat specification is written around one material. It is best to use material specification designations which have gained industry wide acceptance. As a rule, these designations have been used in material procurement specifications and there will be an automatic tie-in between the two.

(b) *The treatment and processing of the material prior to its receipt by the heat treating department should be critically reviewed.* Is the part fabricated from bar, sheet, plate, forging, casting, or extrusion? If an assembly, has there been welding, brazing or soldering performed? Is the part in its rough state, semi-finish machined, or completely finished to size? If rough or semi-finished, what dimensional tolerances exist? Is a bright surface demanded on the part?

The answers to these questions will dictate as to the necessity for furnace atmosphere control, and the procedures to be used in handling and/or fixturing in order to experience a minimum of distortion. In addition, it will tell whether or not you need a stress relief

operation for the purpose of dissipating internal stress.

If there is any doubt concerning prior stock removal by machining, or the presence of internal stress by virtue of some fabrication procedure, it is strongly recommended that provision be made for a stress relief treatment.

(c) *The type of furnace and temperature control are extremely important to the end product.* One should specify any type which provides adequate temperature uniformity and control to fit the needs of the heating operation being performed. It is not unreasonable to require that both temperature uniformity and control be maintained at ±10 F.

(d) *Proper positioning of parts within the furnace.* This fact cannot be overemphasized. Parts must be spaced uniformly and evenly and the mass must be distributed throughout the effective heating area of the furnace hearth. The same applies where parts are suspended in the furnace or where a series of baskets are utilized as the support medium. It is best to specify a single layer except where it is positively known that part size and configuration will permit a minimum of stacking and still not interfere with uniform heating rates from one part to another.

The second of the major categories has to do with the actual heat treatment operation or operations. Sequence of operations becomes very important and the completion of one effectively before subjecting it to the next is vital if the physical property requirements are to be achieved in the end product.

At this point, the gamut of heat treating operations nomenclature enters the picture as they apply to the particular material being processed. Data with respect to the kind of operation and the temperature ranges is readily available from the material fabricator. It remains only for the user to adapt this data to his particular need. Actually, this becomes a twofold proposition: The designer specifies the material and the properties on the part print or sketch and the production, heat treat, and quality departments combine their talents and efforts to deliver the final part.

Let us look behind the scenes for a moment at the conference called for the purpose of establishing these physical properties. (If a conference has not been called, you, the metallurgist and the heat treater, would be well advised to spearhead such a meeting.)

The designer will in all probability be asking for the moon. His demands will include: next to impossible dimensional tolerances, hardness ranges that are far too tight, no distortion, no decarburization, and a material cleanliness requirement that won't even be listed on the J K chart.

These represent points that call for negotiation. The designer must be made cognizant of the fact that materials will sometimes distort, that hardness ranges are not cut-and-dried from heat to heat or even from one design of a part to another, that decarburization may be present from time to time, and extreme material cleanliness is a goal one can only hope to strive for.

His requests must be treated with a realistic approach. This may entail a change in design, production department tooling, and/or fixture modifications, or even a change in material.

The point to keep in mind is this. *The engineering requirements will be indicated on the part drawing. The heat treat specification describes how these requirements are to be achieved.* The two must be compatible with one another.

Carburizing and nitriding are heat treating operations which have gained wide acceptance and have become routine in many applications. Yet heat treaters' files are crammed with case histories of how this or that went wrong. The important thing to bear in mind with respect to both of these operations is that we are dealing with induced chemical reactions at the surface of the part and we must maintain constant control over the many factors which influence the final structures we are creating.

Concerning carburizing:

(a) *Specify strict carbon content of the case.* This should be a minimum of eutectoid carbon and a maximum of 1.00% in the outer .010 in. layer of the case.

(b) *Specify case depth uniformity throughout the load.* For example, a typical case depth range is .025 in. to .035 in., but this does not mean that one portion of the load can be at the lower depth while other portions are at the higher depth. Test specimens placed in the top, middle, and bottom of the load should be required to be uniform within several .000 in. total case depth.

(c) *Specify absence of carbide network or to what degree presence is acceptable.*

(d) *Specify to what degree retained austenite is acceptable,* indicating a hardness increase of not more than a specific number of hardness points after specimens are subjected to a subcritical temperature. Exposure is one way this can be accomplished. Other methods include microstructural examination, x-ray diffraction, or eddy current loss.

(e) *Specify a limited amount of stock removal on the cased area.* It should be remembered that the effective portion of the case is around 30% of the total depth, or that portion which will support a minimum of rockwell "C" 60 or equivalent. An absolute minimum of stock should be removed in order to provide the maximum backup or support to the hard surface.

(f) *Specify cooling in protective atmosphere after the carburizing operation.* Remember, carburizing takes place at fairly high temperature and decarburization will occur if this precaution is not taken.

(g) *During hardening, again, protective atmosphere is essential to prevent decarburization.* As an alternate to this, flash copper plating will give the necessary protection.

Nitriding differs from carburizing in that final case hardness is developed during the nitriding process with

ANATOMY OF A SPECIFICATION • • •

Concluded

no need for subsequent heat treatment. Here are the precautions to be included when undertaking the nitriding method of case hardening:

(a) *For martensitic grades of steel, nitride only after hardening, followed by tempering at approximately 1,000 F.* This will give the uniform tempered martensitic structure so necessary for developing optimum case hardness, depth, and structure.

(b) *Length of time at the nitriding temperature is not so critical as in carburizing.* Nitriding takes place much more slowly, but it must still be specified.

(c) *Stock removal.* The so called "white layer" must be removed but stock removal should end there. Nitrided cases are extremely hard but relatively shallow. Hardness will decrease drastically as material under the white layer is removed.

(d) *The nitriding atmosphere is dissociated ammonia.* The dissociation percentage must be watched closely and maintained throughout the cycle. Generally accepted temperature and dissociation percentage for single stage cycle are 975 F. and 25 to 30%. For double stage cycles, approximately one-fifth of the total nitriding time at the figures given, to be followed immediately by raising the temperature to 1050 F. and the dissociation to 80 to 85%. These conditions should persist throughout the remainder of the cycle.

This category consists principally in specifying the operations in their proper sequence, the temperature range at which the operation is to be performed, and the time interval during which the material is to be held at the temperature specified.

At this stage it is advised that the following precautions be incorporated:

(a) *Time at heat refers to the actual time the material is at the temperature required for the operation,* and not to the time that the furnace has been at that temperature.

(b) *During all heating operations, material shall be heated slowly enough to maintain a practical temperature uniformity through both sections.*

(c) *Some materials tend to be sluggish in their phase changes.* To counteract this characteristic, pre-heating to a temperature in the vicinity of their transformation points is helpful in easing them through this phase change at a temperature as uniform as possible.

(d) *The quenching medium must be clearly indicated.* Again, the material supplier will furnish his recommendations and you will be safe in following them. However, your experience and knowledge of a particular material and part design will, in some instances, permit you to deviate from the recommended practice.

(e) *Care must be exercised in the transfer of parts between certain critical back-to-back operations.* Particularly, parts to be tempered after the hardening operation should be placed in the tempering furnace immediately after cooling to the point where they are warm to the touch. Untempered martensite has a way of asserting itself in the form of cracked parts.

(f) *The advisability for multiple tempering operations is sometimes recommended by the material fabricator.* If so, make certain that you incorporate it in your specification and observe the same precaution mentioned previously for tempering immediately after hardening.

The operations of carburizing and nitriding should be dealt with in a very precise manner, and it would be appropriate to look at them closely at this point.

With regard to the third category, or those factors describing the conditions and characteristics of the material subsequent to heat treatment, we must include in the specification adequate means and provisions for determining that the parts have been heat treated properly in order that proper disposition may be made.

Obviously, we must rely upon non-destructive testing methods for the major portion of parts or material. A very loy percentage may be utilized for destructive tests, but the advances in the science of testing have greatly curtailed this as a routine matter.

Hardness tests are the principal means of checking what the heat treatment has produced. The hardness range and scale are specified on the part drawing and are also to be placed in the specification.

Hardness testing, and the proper techniques to be employed in performing it, is a separate subject. The chief concern in preparing your specification is preparation of the hardness scale which is proper for the material, the thickness of the section, the surface treatment, and the hardness range itself.

Carburized case. (.025 in. and over) medium to heavy depth; Rockwell "C" scale; with Rockwell superficial 15N scale to check; for decarburized layer.

Carburized case. Light depth (up to .025 in.); Rockwell "A" scale or Rockwell superficial 30N scale.

Nitrided case. Rockwell superficial 15N scale.

Alloy Steel. Hardened & tempered Rockwell "C" scale.

Steel. Normalized or annealed light sections—Rockwell "B" heavy sections—Brinell (3000 kg. ld.)

In specifying case depth measurements, several methods are available: (a) Etched (nital) cross-section of the case; (b) Fracture specimen; (c) Hardness step-down.

If physical property requirements such as ultimate strength, yield strength, percent elongation and impact are called for in the materials specification, chances are that these need not be repeated. If required, they would be performed on test bars representative of the heat of material being processed, and, heat treated along with the parts.

Certificate of test is similar in purpose to the material specification. The heat treat specification should include the requirement for a statement of conformance and actual test results for the applicable parts. • • •

HEAT TREATING IS KEY TO PRODUCING PRECISION INVESTMENT CASTINGS MORE ECONOMICALLY

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IT IS DIFFICULT to determine where quality and economy begin in the making of intricate, precise investment castings. Each operation must attain a degree of perfection in order to produce an accurate part. In spite of care and workmanship exercised in making molds, any laxity in the actual casting process can destroy the final quality. Up to the time a part is cast, most operations are performed either at room or slightly elevated temperatures. During the casting process, however, temperatures of over 3,000 F. can be applied. Here, chemical reactions are complex and difficult to control. Pouring must be carefully controlled at temperatures consistent with good practice, since molds can be damaged so severely that parts have to be scrapped. Molds must be cured and held at temperatures where the hot metal does not cause damage through excessive expansion of the mold material. Also, the mold must be free of any trapped gas.

In most instances, the investment casting specification calls for a finished surface, "cast to dimension." At this point arises one of the investment caster's most difficult problems, the maintenance of surface chemistry on the part during casting. Since many different types of material are used throughout the industry, it is sometimes impossible to maintain an ideal surface.

The Hitchiner Manufacturing Company, Milford, New Hampshire, one of the leaders in the investment casting field, places due emphasis on the importance of the actual casting and high heat operations, such as curing of investment molds, melting and heat treating of its finished product.

When Hitchiner built its new plant in Milford, New Hampshire, all heat operations were planned as an integrated department. The unique layout places the four melting furnaces along one wall, with seven mold curing furnaces and three furnaces for treating finished castings in the center of the building. This provides working and transfer areas so work can be transported —with a minimum of handling operations—to the finishing department. With the exception of melting facilities, all furnace and gas generating equipment was designed by Surface Combustion, Division of Midland-Ross Corporation, Toledo, Ohio.

All heating operations are housed in a building with 4,800 sq. ft. of floor area. This procedure provides more economical operation and better quality control. Segregating this activity eliminates heat in the other sections of the plant and reduces noise level. This not only improves working conditions but also minimizes safety hazards.

After preliminary engineering, Hitchiner makes dies from aluminum or steel. These master dies are used to produce expendable wax or plastic patterns of the part eventually to be cast. Wax patterns are sprayed or

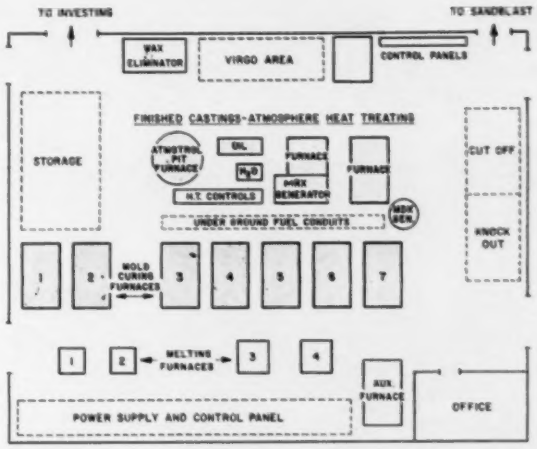


FIG. 1. Unique melting and heat treating layout provides continuous flow of small job lots as well as large production lots with equal economy and quality.

FIG 2. Battery of seven Surface Combustion Conjecto fired furnaces is used to accurately cure and hold molds at proper temperature for pouring.

coated with a thin slurry of fine refractory powder, and allowed to dry. The powder serves as a mold-facing material. Next they are placed in cans or mold containers for investing. A slurry of mold material is then poured into the cans and allowed to dry. During the drying operation the molds are baked at a temperature sufficient to melt the wax patterns. The mold is stored to await scheduling for curing and pouring. Finished molds are stored on special storage shelves located in the casting building. All molds are transported by push or motor fork trucks.

Accurate Temperature Control Vital in Mold Curing

Molds scheduled for curing are placed in one of seven Surface large oven furnaces. These furnaces are strategically located across the aisle from the melting furnace. This is the first of several critical heating operations.

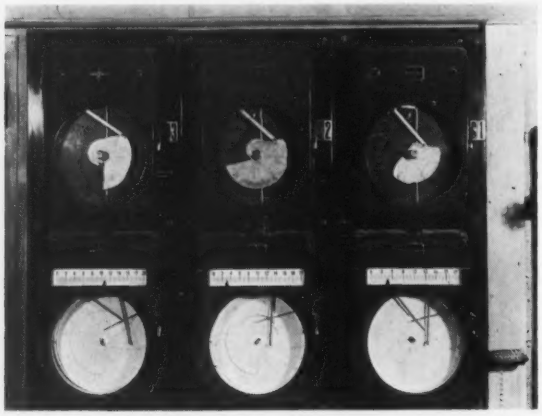
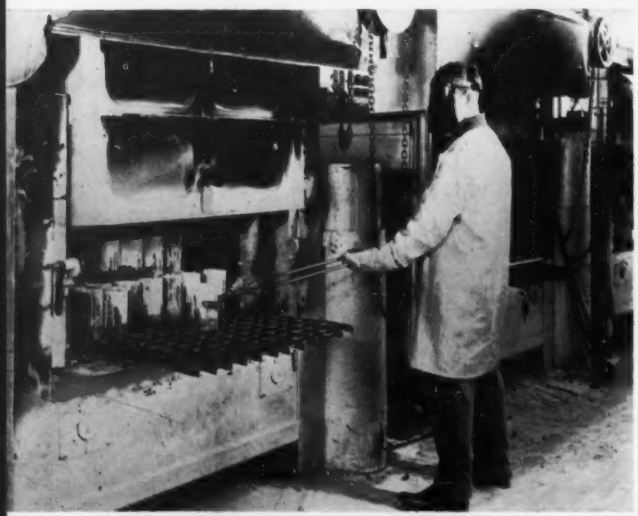


FIG. 3. Some of the cam actuated temperature instruments that are used for precise control of mold curing cycles.

FIG. 4. Workman removes one mold at a time, prior to casting them with molten metal.



In the curing process, molds are heated to and held at curing temperature, usually about eight hours. This operation is critical because the molds must be held at an even temperature and also brought to this temperature at a uniform rate. The curing operation at Hitchiner is performed in any of the seven Surface large oven furnaces. These are particularly adapted to this work because of the Conjecto firing systems of heating. The furnaces are of a semi-muffle type and are direct fired under the hearth and along the roof line from Conjecto burners. The burners bring the temperature to heat fast and uniformly. Each burner block actually has two burners each connected to separate fuel and air lines. During the heating up period, both burners act as normal firing units. However, when temperature is reached at the thermocouple, one of the burners fires normally and the other blows air. The air being heated and circulated through the furnace acts as a convection medium and tends to equalize the blast temperature and provide fast, even heat throughout the furnace.

Furnaces are program controlled to bring the load to temperature at a uniform rate. Held to a temperature for a specified time, furnaces can then be dropped to a lower holding temperature until time for filling molds. Usually molds are charged into large oven furnaces in the afternoon prior to the day of casting. They are then heated and held until casting time the following day. The automatic program control feature and Conjecto-firing system team up to produce full capacity production with a minimum of supervision.

The general layout of the casting department is such that work flows from an entrance door to various process steps and out another door at the end of the room. The Conjecto firing furnaces and the heat treating furnaces are placed in the center of the room, facing an aisle that encircles the central area. Other equipment such as melting furnaces, cleaning equipment, testing and cut-off machines are located across an aisle, along the four walls.

Schedule Melting With Curing Ovens

Molds are removed from the curing and holding furnaces, one at a time, as required for pouring. Loading of mold curing furnaces is scheduled to coincide with the particular melting furnace that will provide molten metal to be cast in the molds in the nearest furnace. After the mold has been filled, metal is allowed to solidify, then taken to a knock-out area. After the cast sprue has been removed from the mold material, castings are cut from the sprues and sand blasted or otherwise cleaned. At this point, parts are given a preliminary surface, chemical and physical inspection, according to the particular specifications to be met.

Versatile Heat Treating Equipment Adds to Quality and Economy

After the cleaning operation, many castings must be heat treated. Since Hitchiner contracts call for castings of very small size to pieces weighing over 35 pounds, batch equipment is particularly adaptable.

The many types of alloys cast into an even greater range of parts of varying specification require different type of heat treatments. Many parts must be carbon restored to correct surface carbon loss and obtain full mechanical properties on the cast surface. Also, certain parts must be carburized, normalized, annealed or straight hardened.

Equipment for heat treating finished castings consists of two Surface gas atmosphere generators; a 500 cfh MDX and a 500 cfh MRX gas generator; a Surface pit "Atmotrol" furnace, a recirculating air draw furnace and a horizontal atmosphere furnace. With these three versatile units, Hitchiner performs a large variety of heat treating operations, either in production lots or in small test runs. The pit furnace is used for carburizing, normalizing, annealing, carbon restoration and hardening. These operations are performed with the protection of a generated gas atmosphere.

The horizontal muffle atmosphere furnace can do the same work as the pit furnace, but is more suitable for hardening, particularly when individual parts or quantities are small or when heating cycles are short. A silicon carbide muffle in the horizontal furnace makes it possible to solution treat stainless and the "PH" grades at temperatures to 2100 F. Beryllium copper parts are also heat treated in these furnaces.

Variety of Parts Matched by Variety of Materials

Hitchiner casts thousands of parts which range in use from toys to missiles. Almost any part capable of being machined can also be cast. The more complicated the machining problem, the greater the possibility that it can be produced more economically by investment casting. Parts are cast from all of the common grades of steel, and most of the stainless steels including the new PH series. Tool steels cast include the oil hardening as well as high speed grades of the air hardening high chrome-high carbon steels. Non-ferrous castings are made from nearly all of the aluminum alloys, Be-Cu and a large variety of brasses and bronzes. Materials used in investment casting are virtually unlimited.

Functional Plant Layout Aids Production

The precision casting process produces a much smoother surface than the ordinary cast surfaces. Also, considerable intricacy of design is obtainable with greater dimensional accuracy. Metal poured seldom represents the major portion of the total cost. Alloys with improved mechanical properties can often be substituted for less desirable alloys at relatively little added expense.

Processing furnaces at Hitchiner are equipped with automatic controls which give complete command over the quality and uniformity of the finished castings. Use of batch type equipment provides the flexibility necessary to a contract-shop operation. Functional plant layout of equipment described in this report has not only been responsible for a minimum of handling costs, but also increased the flow of production. ● ● ●

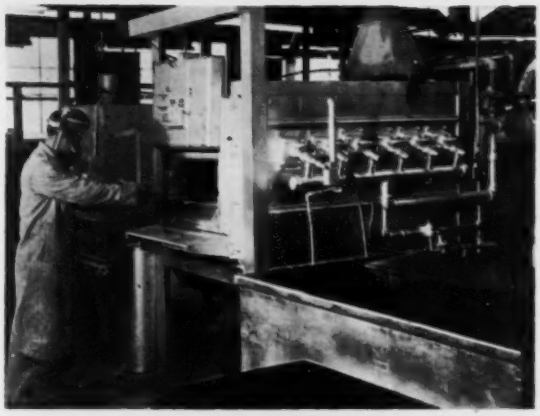


FIG. 5. Heat treater removes finished casting from the horizontal muffle controlled atmosphere furnace ready for quenching.

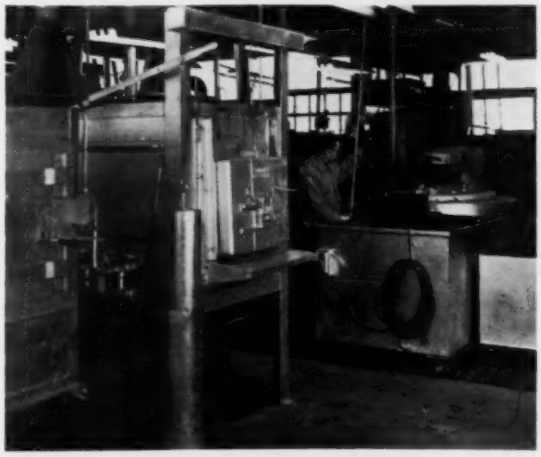
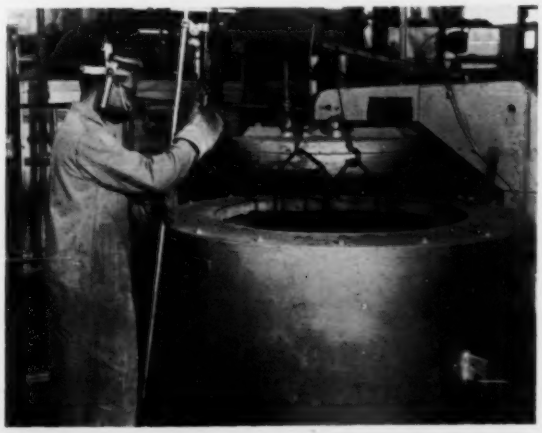


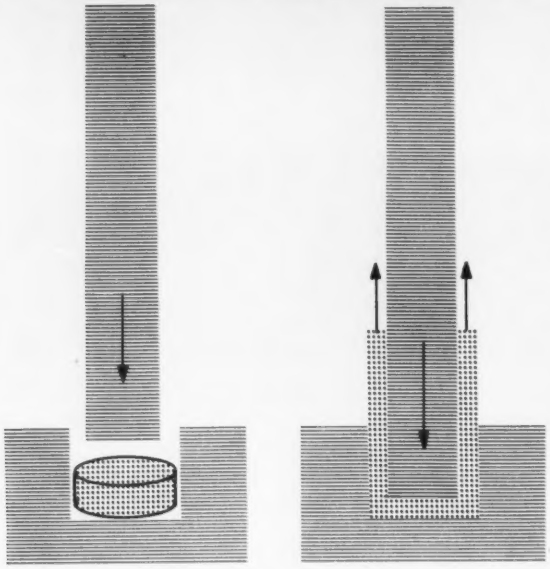
FIG. 6. Three furnaces are all that are necessary for processing thousands of different castings requiring numerous types of heat treatment.

FIG. 7. Operator lowers basket of work into the vertical pit type "Atmotrol" furnace for carburizing. Annealing, carburizing, normalizing, carbon recovery and straight hardening can also be performed in this furnace.



Heat Treatment

FIG. 1. Basic techniques used by Matthews for cold steel impacting.



AN EXTRUSION PROCESS developed by Matthews Corp., Hawthorne, California, is referred to as "cold steel impacting" because it involves the forming of unheated metal slugs in ambient-temperature dies. However, its effective adoption necessitates the use of many different heat treatments, all which are essential to the final beneficial results.

The process permits production of both ferrous and nonferrous components with maximal mechanical strength while relieving the heat treater of direct responsibility for warpage and ductility.

The process is of particular interest because its principles might well be adapted to the manufacture of metal parts other than extrusions, such as certain types of stampings, for example.

Reverse or Backward Impact (Above)

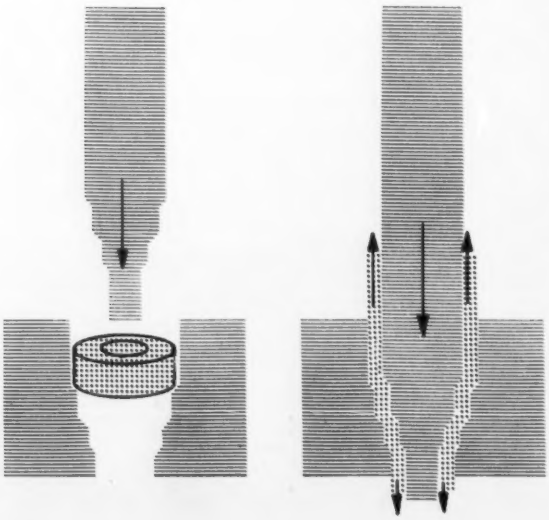
In this method, the direction of the metal-flow is opposite to the direction of the punch travel. Variations in tool design can produce ribs, flutes, splines or bosses as integral parts of the shape.

1. In backward impacting, a closed-bottom die is used. The dimensions of the die-cavity control the outside diameter and configuration of the finished piece.

2. The punch is of a precisely smaller diameter than the cavity. The difference in size between the punch and the cavity equals the desired wall thickness of the finished component.

3. The cold metal slug from which the part is to be formed is placed in the cavity, then the press is actuated. As the punch penetrates the die-cavity, it exerts the necessary pressure on the metal slug to reduce it to a plastic state. In this condition, the metal flows upward around the punch and outward to fill the die-cavity.

4. General contours or details of the punch and die can be designed to give various interior and exterior features as desired.



Forward Impact (Left)

In the forward method, the direction of metal-flow is the same as that of punch-travel.

1. The die is open at both ends, with a portion of the opening serving as an orifice through which the metal flows.

2. The slug may be pierced to accommodate the projection on the end of the punch. Also, forward extrusions can be made without piercing to produce parts with a bottom section.

Combination Impact

Both forward and backward impacting can be combined to produce complex symmetrical shapes not possible when only one of the methods is used.

Parts made with the combination method may have different shapes or diameters produced simultaneously, and may have both solid and hollow configurations in different areas of the part.

# of Cold Extrusions

According to Ray Matthews, president of the company and originator of the technique, cold steel impacting has been made possible by a study of the atomic structures of metals and their behavior under extremely high pressures.

"Research," he says, "has shown that if sufficient external pressure is applied to steel or other metals, deformation will occur along the slip planes within the metal grains. If such pressure continues to mount, the metal will flow under controlled conditions. By utilizing this controlled flow, we can deform a slug and obtain a finished part which weighs almost the same as the slug.

"During my process, metal flows into a die cavity and around a punch, with which pressure is applied. Pressure is then released and the molecules of metal resume their solid state, forming the configuration and dimensions imparted by the tooling. As a result, metal grain is tremendously refined and the end product may have as many as three times the strength of the original fully annealed slug."

Matthews further admits that his process resembles the technique used in the manufacture of such things as toothpaste tubes, except for the fact that it permits the fabrication of structural metals or materials which do not have extreme ductility. In essence, this is accomplished by extruding metals in two or more stages—between which partly formed materials may be either annealed or heat treated, depending on the amount of work to be done. (Figure 1.)

A heat treatment usually precedes the final extrusion stage. Besides improving a metal's properties, it leaves the component with sufficient ductility to go through the final stage without being excessively work hardened. In fact, work during the latter stage not only eliminates such things as warpage due to the heat treatment, but also makes a substantial and highly reliable contribution to the finished properties of a part.

When 4130 steel is conventionally extruded and heat treated, 160,000 p.s.i. is generally considered to be the highest tensile strength that can be obtained. Matthews' process, however, is said to provide parts from the same steel having 200,000 p.s.i. tensile strength, plus dimensions that are accurate within 0.001 in. to 0.005 in. and proper carbon content without supplemental processing.

In processing 4130 steel, Matthews has parts heat treated to 140,000 p.s.i. tensile strength immediately prior to the final stage of the cold extrusion process.

According to officials of California-Doran Heat Treating Company, the Los Angeles firm that has thus far handled most of Matthews' heat treating and an-

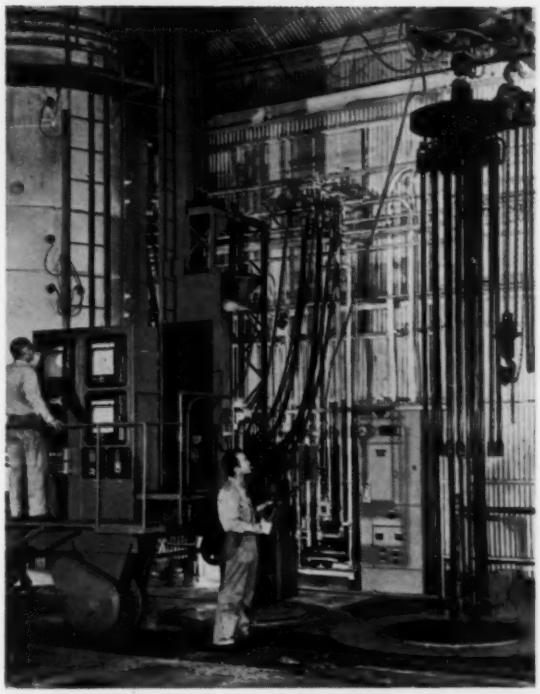


FIG. 2. The Matthews cold extrusions are shown here, suspended below a special heat treating fixture above the pit, where they have been quenched in the California-Doran plant.

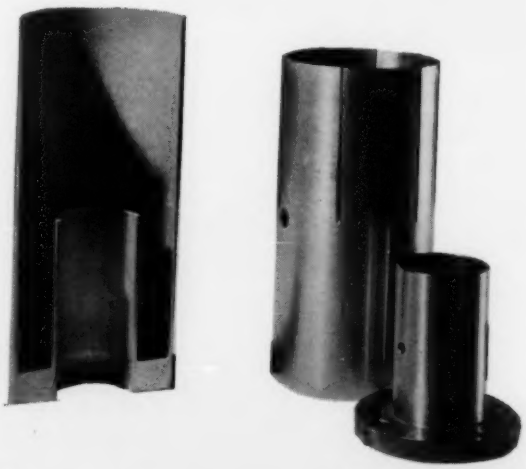


FIG. 3. At one time it was necessary to fabricate two parts in order to make component shown in right background. The latter is now being extruded in one piece (left) by Matthews.

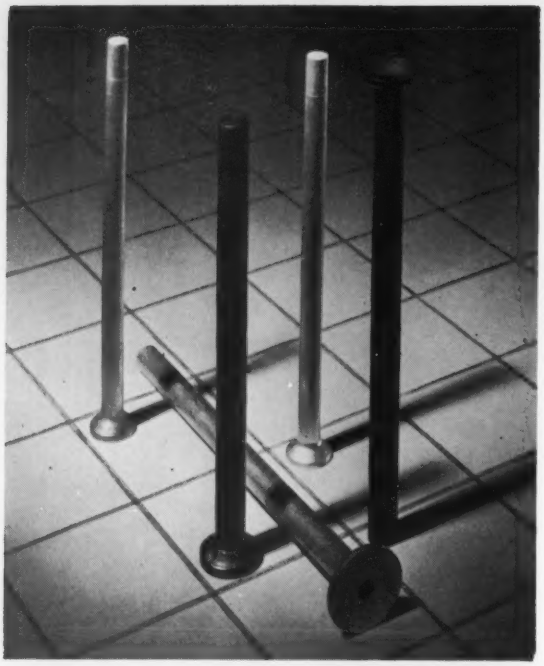
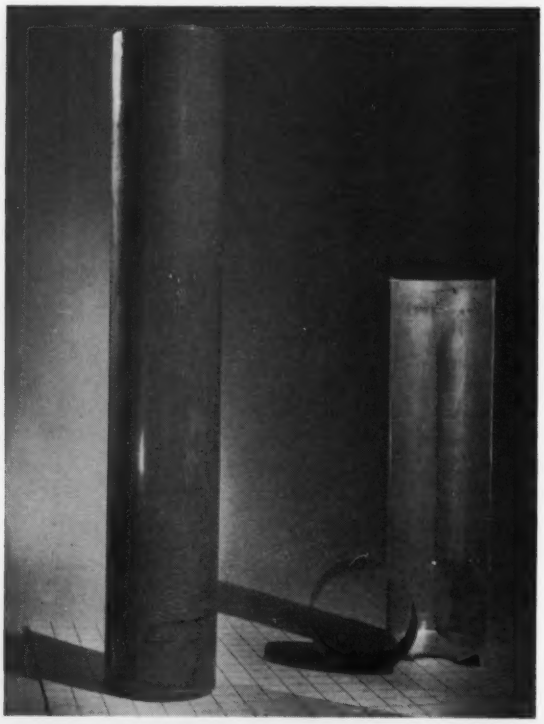


FIG. 5. Extrusions such as type shown above may have walls as thin as 0.005 in. when made by Matthews' new impacting process.

FIG. 4. Thermocouple tubes shown here are being extruded by Matthews from copper, steel, and aluminum. Some have diameters as small as ⅛ in.



HEAT TREATMENT OF COLD EXTRUSIONS

Concluded

nealing operations, the subject process does not eliminate the need for good furnaces and metallurgical know-how. (Figure 2.) Officials point out that oxidation of many structural metals cannot be prevented without the use of inert gases in heating them; and temperatures must be held within fairly close tolerances in order to obtain any specified combination of ductility and tensile strength.

However, they add, Matthews' process does permit the use of standard heat treatments which are relatively reliable by eliminating the need for maximal strength following each treatment. In addition, such work can be done with relative economy because any distortion or decarburization that may occur can be eliminated by subsequent cold work.

Heat treatments are of additional significance in the fabrication of dies which have helped make cold steel impacting practical. The dies are roughly machined from AISI D2 tool steel, advantages which include deep hardening properties and high compressive strength. Following machine work, each die is heated to 1850 F., air quenched, and double-drawn for maximal hardness. It is then precision ground to finish dimensions, drawn at 950 F., and air cooled.

Matthews claims dies made by this process can be used to extrude from 150,000 to 200,000 parts before they must be replaced, while a comparable tool for conventional hot working applications can be used to produce only about 5,000 parts.

Another treatment which is used to prepare fully annealed steel slugs for cold steel impacting involves pickling the materials in sulfuric acid, rinsing in cold water, and treating with zinc phosphate at 135 F. The zinc phosphate is neutralized at 130 F., after which the slugs are coated with a soapy commercial lubricant at 160 F. In this connection, zinc phosphate serves the purpose of a reactive-type lubricant which adheres to each steel workpiece throughout the extrusion process.

Cold steel impacting permits the manufacture of parts with virtually all the configurations that can be conventionally extruded. (Fig. 3.) In addition, it can be used to make such things as hollow parts with one of their respective ends closed or partly closed, (Fig. 4) pressure-tight vessels, closed tubes with flanges or heavy wall sections in single end areas, components with variable base and sidewall thicknesses, and parts with such details as bosses, lugs, ribs, flutes, gears, and projections. (Fig. 5.)

In the latter capacity, the process has been particularly economical because it has permitted the fabrication of single units which could serve the purpose of relatively complicated assemblies. Where equivalent parts might be made by other means, it is reported to save money in many instances by minimizing scrap losses, tooling costs, and machining requirements.

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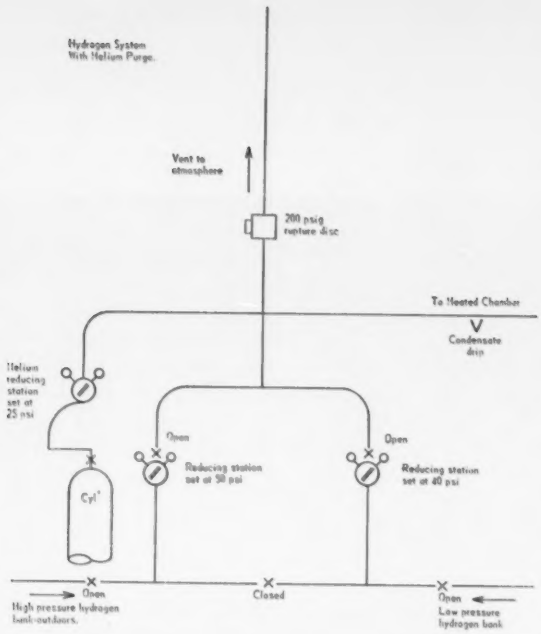

Safeguarding Nichrome Brazing in Hydrogen

LINDSEY HOBEN

Oak Ridge, Tennessee

OXYGEN CONTAMINATION during brazing frequently results in discoloration. Thus, a hydrogen atmosphere is often indicated for a successful brazing operation. Indeed, the use of hydrogen not only precludes the possibility of contamination, but at the same time presents but few operational problems, all of which can be eliminated through the use of techniques described in this report.

Hydrogen has been used effectively in conjunction with the Pease brazing process, a technique that employs special braze powders and flux material. Both compounds are carefully applied to seams that require joining. The entire ensemble is then sealed in a metal case equipped with two copper tubes—tubes which in turn provide for intake and exhaust of hydrogen gas. The container itself is sealed off for a short period while being heated in an electrical furnace to 1800 F.

At this point valves are opened to the manifold and escaping gas is lighted. Flame coloration is indicative of container atmosphere as the temperature is raised to 2100 F. This temperature is held for two to three hours, depending on the size of the piece being brazed.

Hydrogen has a wide explosion range when mixed with the various elements contained in common air, thus at the temperatures used in this process the hazard is greater. Gas-air combinations in the chamber—either accidently accumulated or occasioned by carry-through when gas is cut off and then resumed—tend to cause explosions.

A special pipe and tank layout can overcome the hazard occasioned by hydrogen being fed to the brazing chamber through copper lines from an outdoor manifold. This arrangement employs two banks of cylinders connected through a pressure reducing station. Use is also made of parallel banks. In banks regulated for different pressures there is no movement of gas from the low pressure side until the pressure from the high pressure bank either falls to, or below the lower pressure.

The most popular technique makes use of 40 to 50 pound banks of cylinders. The high side furnishes gas up to the stage where its pressure drops below 40 p.s.i. At that value the low pressure bank automatically furnishes gas, providing an uninterrupted flow to the welding enclosure as the exhausted bank is being serviced with filled cylinders.

Failure to change cylinders promptly, careless setting of reducers and valves, maintaining them improperly, and inept mechanical service procedures—all can result in the loss of gas pressure to below that of atmospheric pressure, a situation leading to explosive conditions. A simple modification can eliminate this problem for all practical purposes. It consists of adding a cylinder of helium coupled to a network, permitting it to purge the entire hydrogen line, should pressure failure occur. This helium purge hook-up is put into operation by adjusting the helium cylinder regulator to a value of 10 to 20 pounds p.s.i. below that of the hydrogen bank pressure. (Correct value is 25 pounds for the average installation.)

The diagram shown here indicates a two bank hydrogen supply system with the helium purge facility incorporated. This arrangement has proved extremely effective as a safety precaution for all brazing operations employing hydrogen as a protective atmosphere.

The best practice calls for venting the waste gas to the atmosphere at a point where ignition from accidental sources is remote if not impossible. Should the vent orifice be installed above the roof line, thus exposing the operation to a lightning hazard, a lightning rod at an elevation above the orifice is indicated.

For brazing operations that are temporary in nature,

Concluded on page 35

Cut Manufacturing Costs with a Roller Hearth Furnace

W. E. FRANK
Caterpillar Tractor Co.
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and

W. J. SMITH
General Electric Co.
Shelbyville, Indiana

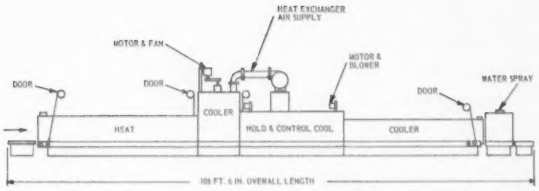


FIG. 1. Brief outline of roller hearth furnace.

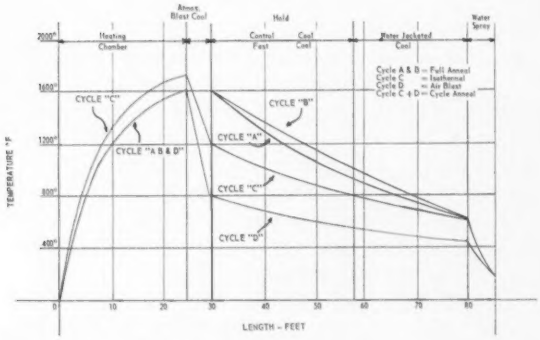


FIG. 2. Various cycles of unit.

Heat Treating Case Histories — Case No. 7

HEAT TREATING is a particularly fruitful field for lowering manufacturing costs. Caterpillar Tractor Company took advantage of the basic cost saving fundamentals of (1) eliminating manufacturing steps, (2) combining of processes, and (3) simplifying operations when selecting heat treating furnaces for their new plant in Aurora, Illinois.

Considerable savings in initial investment and floor space were anticipated by planning to process large tonnages of a variety of parts through a single continuous furnace of great flexibility. It was found that further savings could be made by elimination of costly subsequent operations which would be necessary with less versatile equipment. The General Electric Company's industrial heating department designed and built two such furnaces.

Caterpillar Tractor Company's metallurgical requirements dictated the processes to be followed, but the selection of an atmosphere tight electric roller hearth furnace over other types of continuous furnaces was a result of the following cost savings that could be realized.

1. Over substantial periods of time, roller hearths have repeatedly proved to have lower maintenance costs. This is due to rolling friction rather than sliding friction such as a pusher furnace and to the elimination of pushing stresses on the work holders.

2. More work per pound of work holder, since lighter weight alloy trays can be used.

3. Continuous operation, since work in the furnace progresses independently of new work being introduced; whereas pusher furnaces, for example, require an additional tray each time the load progresses.

The reduced costs attributable to combining operations were a large factor in Caterpillar's selection of equipment. Costly cleaning operations have been eliminated by the atmosphere within the furnace, permitting scale free treating of a variety of constructional steel, ranging from grain refinement to isothermal annealing. The furnace is required to full anneal, cycle anneal, isothermal anneal, or atmosphere blast quench in protective atmosphere. Various loads of steel ranging from 1800 pounds per load to 3300 pounds per load on a tray 54 in. by 48 in. long can be processed. Net production is 3000 pounds per hour.

A brief outline of the furnace is shown in fig. 1, and the various cycles are illustrated in fig. 2. Considerable operator time is saved, since all cycles of the furnace are controlled through a single cycle selector switch. This enables the operator to select the desired cycle by merely turning the indicator and setting the temperature control instruments. Application of the various cycles is as follows:

Cycle A. Used on miscellaneous forgings of medium carbon steel requiring "anneal for machinability".

Cycle B. Used on large tonnages of medium carbon hardenability controlled steel. Unit weights vary from 3.3 to 36.0 pounds. Sections vary from 5/16 to 5/8 in. for the smaller forgings, to ½ to 1⅞ in. for the larger

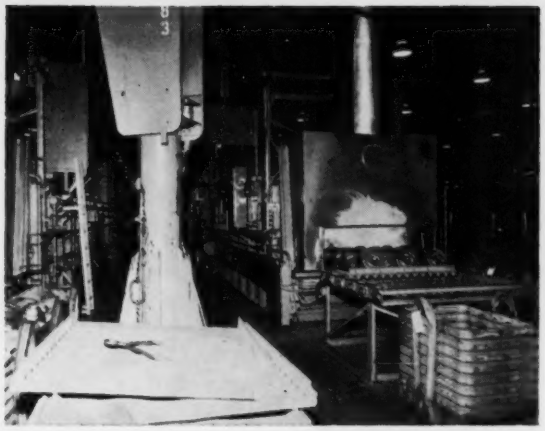


FIG. 3 Charge end of General Electric roller hearth furnace showing work being introduced into the furnace prior to cycle annealing.

FIG. 4. Discharge end of General Electric roller hearth furnace showing work being water spray cooled as it leaves the furnace.

forgings. This cycle will produce an optimum structure for large volume machining of forged parts which subsequently are drastically water quenched to produce close tolerance bore diameters after hardening.

Cycle C. An isothermal anneal for hardenability controlled 8617, 8720, and 8822 forged gear blanks. Unit weight varies from 13 to 106 pounds. Sections vary from ⅜ in. to 6½ in. The resulting structure is the best compromise known for: drilling, broaching, turning, hobbing, and shaving and then responding to subsequent carburizing, reheat and oil quench with a minimum of distortion.

Cycle D. An atmosphere blast quench which will produce an excellent machinable structure with a consistent and satisfactory yield strength for certain classes of parts, from medium carbon steels, in both straight carbon and alloy grades.

The furnace is constructed of four main sections consisting of the heating chamber, atmosphere blast cooler, combination holding and control cooling chamber, and water-jacketed cooler. The heating chamber is a straight through section with a fast run-in and fast run-out drive mechanism. Sight glasses are placed at frequent intervals for observing the work. The atmosphere blast cooler is special due to the rapid cooling which must be accomplished as outlined in Cycles C and D (fig. 2). Atmosphere circulation in the chamber is accomplished by a centrifugal type fan powered by a 100 HP motor. Alloy baffles direct the flow of circulating atmosphere outward from the blower down both side walls, up through the charge, and through a heat exchanger into the fan. The heat exchanger transfers heat from the atmosphere within the chamber to outside air. This eliminates requirement of a recirculating filtered soft water system and the pumping of 3000 to 4000 gallons of water per hour per furnace which would normally be required with the usual water-cooled type heat exchangers.

General Electric Calrod heating units are also installed in the chamber, and are automatically controlled by the same instrument which controls cooling.

In the event that the temperature of the atmosphere circulated by the 100 HP blower tends to drop below the desired value, the cooling air valve is closed and electric power is applied to the heating units to maintain the desired temperature. The chamber immediately following the atmosphere quench chamber has a triple purpose. It serves as a regular cooling chamber, a controlled cooling chamber and a holding chamber. The unit is constructed with zone temperature control consisting of heating units and cooling tubes. Either or both may be used depending upon the cycle. Following this section, a straight water-jacketed cooler is utilized for cooling. At each internal door, an access plug is constructed on each side of the furnace. It may be removed for inspection and maintenance.

The equipment includes a signal light monitor panel, equipped with indicating light and a graphic diagram painted on the front. Signals are sent from the furnace to this panel, which is supported above and to the operating side of the furnace, enabling the operator to detect at a glance all normal or abnormal furnace conditions. The indicating lights show open doors, closed doors, location of trays, operation of fans and blowers. Any furnace malfunctions are indicated both visibly and audibly.

In a cost conscious economy, where continuous processes are becoming increasingly necessary, this furnace offers considerable flexibility and lower cost heat treating. ● ● ●

WHAT WOULD YOU DO?

a problem in labor arbitration taken from the files of the American Arbitration Association

CASE OF THE ONE DAY RECALL

Under the union contract at a wire and cable manufacturing company, management was obligated to give employees at least five days' notice before laying them off. In accordance with that provision, Wilbur D., a maintenance man, was laid off during August 1960.

A few weeks later some repair work, expected to take about eight hours to complete, became necessary. On September 10 a registered letter was sent to Wilbur, directing him to report for the one day of work on September 16. At the same time it gave him official notice that he would be laid off again at the completion of his shift that day.

The union objected. "You can't give a man notice of layoff while he's already laid off," the international representative insisted. "When you call him back to work you have to give him at least five days."

"Not so," answered the personnel manager. "There is nothing in the contract to prevent what we're doing. If we couldn't call in the senior man from layoff for one day of work, when that's all we have, we'd have to get the repair job done by an outside contractor."

The dispute couldn't be settled in grievance procedure and eventually went to an arbitrator under the rules of the American Arbitration Association.

THE AWARD. Reading the whole contract, the arbitrator noted that the definition of "employees" clearly included those on layoff. He consequently found no fault with the company for giving an employee notice of layoff before he was actually in a work status. Furthermore, there was a four hour call-in pay provision in the agreement which would have been rendered meaningless if a call-in had to result in at least five days of work.

THE CASE OF THE SHORT-LIVED VACANCY

When one of three final inspectors in a shop manufacturing equipment for the chemical industry had to go to the hospital for an operation, Don L., whose regular job was sub-inspector, was asked to fill in. The absence was expected to be for about two months and Don looked forward to that period of time at the higher rate.

But three weeks later management decided that the two regular final inspectors could handle the load. They therefore ordered Don back to his sub-inspecting job at the lower rate.

"Wait a minute," protested the shop steward. "Once you assign a man to a vacancy you have to keep him there till the regular man returns to work." To support that contention, he quoted a contract clause that said temporary assignments were to be made "for the duration of the vacancy."

The personnel manager had a ready answer: "Absence is one thing, and a vacancy is another. Work slackened off and the vacancy no longer exists, even though the regular man is still absent."

THE AWARD. The arbitrator agreed with management. "Absence is, in its simplest form, the non-presence of an individual," he said. "Such non-presence is a matter of fact. The word 'vacancy', however, cannot be defined so generally. Where the absent employee has been replaced and such replacement has been terminated prior to the return of such absent employee, the company in effect has determined, as it has a right to, that the vacancy has also terminated." If the contract had referred to "the duration of the absence" instead of "the duration of the vacancy," the decision would have gone the other way.

About People.....

Moxness Appointed To Honeywell Position

The appointment of John B. Moxness as manager of pyrometer supplies for Minneapolis-Honeywell's Brown Instruments division has been announced.

Moxness will supervise sales, engineering and manufacturing operations headquartered in Philadelphia and also coordinate these with activities of other company divisions.

Since joining Honeywell in 1946, Moxness has held sales and administrative posts in Minneapolis, Cleveland, Wabash, Indiana and Philadelphia. Recently, he held the position of pyrometer supplies and accessories manager.

Pacific Scientific Elects

Robert V. Eldridge has been elected secretary and treasurer of Pacific Scientific Company.

Eldridge is a graduate of the University of Washington and the

Robert V. Eldridge

Harvard School of Business. He joins Pacific Scientific from Federal-Mogue-Bower, national seal division where he has been controller for six years.

Hamilton to Head SAMA

R. G. Halvorsen, executive vice president of Hamilton Manufacturing Company, Two Rivers, Wisconsin, was elected president of the Scientific Apparatus Makers Association at the apparatus makers' 43rd annual meeting held last April. He succeeds Dr. G. A. Downsbrough, president, Boonton Radio Corporation, Boonton, New Jersey, who has held the office the past two years.

SAMA is the national trade association of 216 companies producing the "tools of science"—scientific instruments, apparatus and furniture—for the country's vast programs of science and technology in industry, government, education and medicine.

Halvorsen has held many executive positions with SAMA since 1949 and was most recently member of the SAMA Board, president pro tempore, vice chairman of the executive committee and a member of the finance, meeting place and staff service committee.

Assistant Sales Post To Robert M. Simpson

Robert M. Simpson has been appointed assistant director of sales of the Crucible Steel Company of America. In his new position, he will assist in the direction of all sales activity of the company and will act as second in command to Josef H. Buerger, Jr., Crucible's director of sales. His work will include supervision of both field sales, through the 38 branch warehouses and sales offices, and the sales managers of product divisions.

In his previous assignment as assistant general manager — field sales, Simpson was instrumental in the expansion and improvement of Crucible's distribution system. Since 1957, when he was given this responsibility, Crucible branch warehouses have been added in six new cities, and 10 facilities in other cities have been replaced with larger, modern warehouses.

Simpson, a native of Minneapolis, Minnesota, was graduated from the University of Michigan, and did

Robert M. Simpson

graduate work at the University of Minnesota, Carnegie Institute of Technology and the University of Pittsburgh. He joined Crucible Steel in 1940 in the metallurgical department. Prior to his sales executive assignment in Pittsburgh, he had managed Crucible's branch warehouses in San Francisco and Los Angeles.

He has been active in the National Sales Executive Club, Steel Service Center Institute, the American Society for Metals, the American Management Association and other organizations.

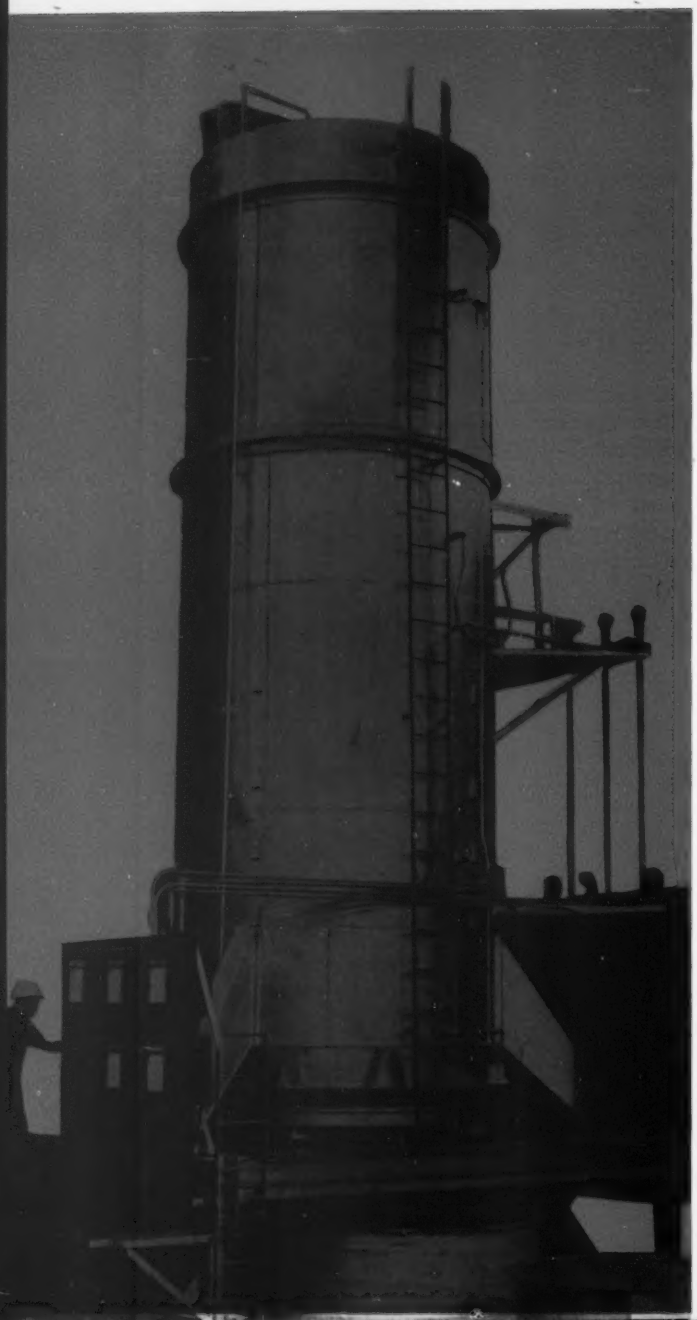
The father of four sons, Robert has devoted time to many youth activities including Little League Baseball and the Boy Scouts of America.

Selas V.P. Job to Bigelow

C. Glen Bigelow, Jr., has been elected vice president of research at the Selas Corporation of America, according to an announcement by F. O. Hess, president.

Bigelow joined Selas in March 1958 as director of research, coming from American Machine and Foundry Company where he had

Continued on page 26



HAVE YOU A HEAT TREATING PROBLEM?

Take it to your Commercial Heat Treater for:

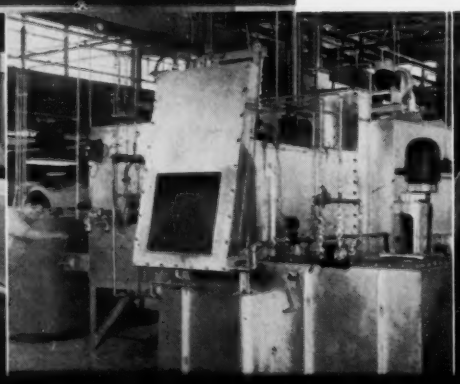
DESIGN: Technical advice about the *design* of meta parts requiring heat treating.

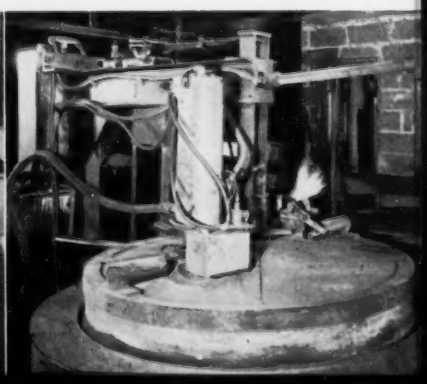
PROCESS: Facts as to the correct heat treatin *process* required to achieve service requirements.

EQUIPMENT: The variety of modern specialize *equipment* needed for efficient cost saving opera tions.

SKILLS: The operational *skills* developed by years o experience in all phases of ferrous and non-ferrou metal treatments.

All these add up to SERVICE –the type of service only the Commercial Heat Treater can provide.





THERE'S A HEAT TREATING SPECIALIST NEAR YOUR PLANT

ALABAMA

Southern Metal Treating Co., Inc.
3131 10th Ave. N., Birmingham 4

CALIFORNIA

Downey Steel Treating Co., Inc.
9637 Nance St., Downey
Columbia Industries, Inc.
6057 State St., Huntington Park
National Heat Treating Co., Inc.
1833 W. Florence, Inglewood 1
Certified Steel Treating Co.
2454 E. 58th St., Los Angeles 58
Lindberg Steel Treating Co.
2910 S. Sunol Drive, Los Angeles 23
Cook Induction Heating Co.
4925 East Slauson Ave., Maywood

CONNECTICUT

Commercial Metal Treating, Inc.
89 Island Brook Ave., Bridgeport 6
Stanley P. Rockwell Co.
296 Homestead Ave., Hartford 12
Ireland Heat Treating Co.
512 Boston Post Road, Orange

FLORIDA

Rex of Florida, Inc.
1881 S.W. 36th St., Fort Lauderdale

ILLINOIS

Accurate Steel Treating Co.
2226 W. Hubbard St., Chicago 12
Allied Metal Treating Corp. of Illinois
333 N. California Ave., Chicago 12
Dura-Hard Steel Treating Co.
2112 W. Rice Street, Chicago 22
Perfection Tool & Metal Heat Treating Co.
1756 West Hubbard St., Chicago 22
Fred A. Snow Co.
1942 West Kinzie St., Chicago 22
American Steel Treating Co.
P. O. Box 396, Crystal Lake
Lindberg Steel Treating Co.
1975 N. Ruby St., Melrose Park
Eklund Metal Treating, Inc.
721 Beacon St., Rockford
Scott Ford, Inc.
2719 Fifth St., Rock Island
Ipsenlab of Rockford, Inc.
2125 Kishwaukee Street, Rockford
O. T. Muehlemeyer Heat Treating Co.
1500 Preston St., Rockford

INDIANA

Quality Steel Treating Company
3860 Prospect St., Indianapolis
Industrial Heat Treating & Metallurgical Co., Inc.
2131 Northwestern Ave., Indianapolis 2

MASSACHUSETTS

Kinetics Corporation, a Division of High Vacuum Equipment Corp.
2 Churchill Road, Hingham
Porter Forge & Furnace, Inc.
74 Foley St., Somerville 43

MASSACHUSETTS — (Cont'd)

New England Metallurgical Corp.
475 Dorchester Ave., South Boston 27
Springfield Heat Treating Corp.
99 Margaret Street, Springfield
Greenman Steel Treating Co.
284 Grove St., Worcester 5

MICHIGAN

Anderson Steel Treating Co.
1033 Mt. Elliot Avenue, Detroit 7
Bosworth Steel Treating Co.
18174 West Chicago Blvd., Detroit 28
Commercial Steel Treating Corp.
6100 Tireman Ave., Detroit 4
Commonwealth Industries, Inc.
5922 Commonwealth Ave., Detroit 8
Vincent Steel Process
2424 Bellevue Ave., Detroit 7
State Heat Treat, Inc.
520 32nd Street, S. E., Grand Rapids 8
Royal Oak Heat Treat, Inc.
21419 Dequindre, Hazel Park
Vac-Hyd Processing Corp.
116 Manchester, Highland Park 3

MISSOURI

Lindberg Steel Treating Co.
650 East Taylor Ave., St. Louis 15
Paulo Products Co.
5711 West Park Ave., St. Louis 10

NEW JERSEY

Fred Heinzelman & Sons, Inc.
790 Washington Avenue, Carlstadt
American Metal Treatment Co.
Spring and Lafayette Sts., Elizabeth
Benedict-Miller, Inc.
Marin Ave. & Orient Way, Lyndhurst
Bennett Heat Treating Co., Inc.
246 Raymond Boulevard, Newark 5
L-R Metal Treating Corp.
107 Vesey St., Newark 5
Temperature Processing Co., Inc.
228 River Road, North Arlington

NEW YORK

Owego Heat Treat, Inc.
Rural Route 1, Apalachin
Eastern Heat Treating & Brazing Corp.
44 Sea Cliff Avenue, Glen Cove
Alfred Heller Heat Treating Co., Inc.
391 Pearl St., New York 38
Lindberg Steel Treating Co.
620 Buffalo Road, Rochester 11
Rochester Steel Treating Works
962 Main Street, E. Rochester 5
Syracuse Heat Treating Corp.
1223 Burnet Ave., Syracuse 3

OHIO

Queen City Steel Treating Co.
2980 Spring Grove Ave., Cincinnati 11
Ferrotherm Co.
1861 E. 65th St., Cleveland 3
Lakeside Steel Improvement Co.
5418 Lakeside Ave., Cleveland 14

OHIO — (Cont'd)

George H. Porter Steel Treating Co.
1273 East 55th Street, Cleveland 3
Reliable Metallurgical Service, Inc.
3827 Lakeside Ave., Cleveland 14
Winton Heat Treating Co.
20003 Lake Road, Cleveland 16
Dayton Forging & Heat Treating Co.
2323 East First St., Dayton 3
Ohio Heat Treating Co.
1100 East Third St., Dayton 2

PENNSYLVANIA

Drever Company
Red Lion Rd. & Philmont Ave., Bethayres
Robert Wooler Company
Dresher
Wiedemann Machine Co.
Gulph Road, King of Prussia
J. W. Rex Co.
Eighth and Franconia Avenue, Lansdale
Lorenz & Son
1351 N. Front St., Philadelphia 22
Metlab Company
1000 E. Mermaid Lane, Philadelphia 18
Pittsburgh Commercial Heat Treating Co.
49th St., and A.V.R.R., Pittsburgh 1

TENNESSEE

Mid-South Metal Treating Co.
463 Scott St., Memphis 12

TEXAS

Dominy Heat Treating Corp.
P. O. Box 5054, Dallas
Superior Heat Treating Co., Inc.
P. O. Box 69, Fort Worth 1
United Heat Treating Company
2005 Montgomery Street, Fort Worth 7
Cook Heat Treating Co., of Texas
6233 Navigation Boulevard, Houston 11
Houston Heat Treating Company, Inc.
2100 Quitman Street, Houston 26
Lone Star Heat Treating Corp.
5212 Clinton Dr., Houston 20

WISCONSIN

Allied Metal Treating Corp.
P. O. Box 612, Milwaukee 1
Heat Treating Engineers, Inc.
1146 North 54th St., Milwaukee 8
Metal Treating, Inc.
720 South 16th St., Milwaukee 4
Supreme Metal Treating Co.
4440 West Mitchell St., Milwaukee 14
Thurner Heat Treating Co.
809 West National Ave., Milwaukee 4
Wisconsin Steel Treating & Blasting Co.
1114 South 41st Street, Milwaukee 15
Harris Metals, Inc.
4210 Douglas Ave., Racine

All of the above listed firms are members of the

METAL TREATING INSTITUTE

Box 448, Rye, New York

MTI MASTER CRAFTSMEN METAL TREATING INSTITUTE

For further information circle No. 8

ABOUT PEOPLE • • •

Continued from page 23

served as technical director of the General Engineering Laboratories, Greenwich, Connecticut, and new products secretary in the firm's New York headquarters.

He was also previously associated with Loftus Engineering Company, Pittsburgh, Pennsylvania, as assistant chief engineer, and with U. S. Gypsum Company as research engineer at the building materials research laboratories, Chicago, Illinois.

Special Products Rep.

John W. Givens, office manager of the Detroit sales district for Latrobe Steel Company, has been assigned to the company's special products division as a sales representative in the Motor City.

John W. Givens

Givens will service jobbers, dealers and distributors with the Latrobe line of flat ground stock, tool bits, drill rod and wear parts.

A native of Pittsburgh, he is a graduate of Duke University, taking advanced work in metallurgy at Temple University.

Changes at American Gas

The American Gas Furnace Company, Elizabeth, New Jersey, has announced a number of changes in management, effective July 1, 1961.

P. C. Osterman, former president, has been elected chairman of the board of directors. Succeeding him in the president's chair is J. B. Crabtree, a former vice president of the firm.

F. C. Schaefer, former sales manager, has been appointed executive vice president and Louis A. Montski, former office manager, has assumed the position of secretary-treasurer.

Cox Is New P.C.H.T. Prexy

Elmer J. Cox has been named president of Pittsburgh Commercial Heat Treating Company. He was formerly vice president of that firm. A member of P.C.H.T. since 1945, Cox succeeds A. M. Cox who has been named Chairman of the Board.

Pittsburgh Commercial Heat Treating Company was established in 1922. It serves a wide variety of industries and is involved with a broad range of products from parts of missiles to those used in atomic submarines.

Elmer J. Cox

Pittsburgh Commercial Heat Treating Company is a division of Cox Industries, which includes J. P. Devine Manufacturing Company, Pittsburgh Wire Form & Manufacturing Company and Pride Manufacturing Company.

G.E. Sales Manager

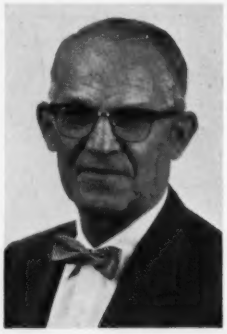
Marion S. Richardson has been named to the newly created position of sales manager, industrial furnaces, at the General Electric Company's industrial heating department, Shelbyville, Indiana.

The new post will provide a headquarters sales component for industrial furnaces that will enable the department to provide faster service and closer customer contact.

Richardson will be responsible for sales of all standard and special furnaces including mesh belt, roller hearth, box, pusher, bell, elevator, car bottom, pit and gantry units.

Joins Loftus Staff

Harold E. Metcalfe has joined the sales engineering staff of Loftus Engineering Company.



Harold E. Metcalfe

Metcalfe is a mechanical engineer with 20 years' experience in industrial furnace application in the ferrous and non-ferrous industry.

A.S.M. Adv. Manager

The appointment of Fred Stanley as advertising manager of American Society for Metals periodical publications has been announced by A. P. Ford, director of communications for the Society. Stanley succeeds William J. Hilty, who has been named exposition manager. Both will operate in the ASM communications department.

Stanley was appointed advertising manager after five years as the Society's regional manager in Philadelphia. He now will supervise activities of an ASM field staff with

Fred Stanley

offices in New York, Pittsburgh, Metals Park (Cleveland), Detroit and Chicago, with representatives in Los Angeles, San Francisco and

overseas. He will be responsible for advertising pages in *Metal Progress*, ASM magazine of materials and process engineering, and *Metals Review*, metalworking news magazine for ASM members.

To Engineer Post

The promotion of Roland C. Crans to the post of assistant chief engineer of Holcroft & Company, Detroit, Michigan, has been announced here by Walter H. Holcroft, president.

Crans brings 21 years' engineering experience to his new assignment. He joined the company's engineering department in 1940 following attendance at the University of Michigan.

Roland C. Crans

A member of the American Society for Metals, he also belongs to the American Society of Mechanical Engineers and is presently Detroit Section Representative to ASME's Region V Membership Development Committee.

A.G.F. Reps Announced

Recent appointments in representation of the American Gas Furnace line have been announced from the firm's headquarters at Elizabeth, New Jersey.

Paul Crafton, Consolidated Engineering Company, Atlanta, Georgia, will represent the American Gas Furnace line in North Carolina, South Carolina, Georgia, East Florida and East Tennesse.

Another Consolidated Engineering sales representative, Henry Arnold, Birmingham, Alabama, will handle the A.G.F. line in Alabama, Mississippi, West Tennessee and Northwest Florida.

The Edward W. Mooney Company, Clayton, Missouri, has been selected to represent A.G.F. in Eastern Missouri and Southern Illinois.

Production Control Mgr.

Latrobe Steel Company has named Edwin F. Kruzynski as manager of its production control department. In this position Kruzynski will be in charge of all production scheduling and coordination of production operations with requirements for finished products, and "in-process" inventories.

Edwin F. Kruzynski

Kruzynski joined Latrobe Steel seven years ago in the production planning department. He was promoted to staff assistant to the manager of production control in 1956, then to supervisor of production scheduling in 1960.

Temptron Product Mgr.

William Draganchuk has been appointed to the newly created post of product manager for Temptron, Inc., Reseda, California.

William Draganchuk

Draganchuk formerly was associated with General Cable Company of Bayonne, New Jersey as technical coordinator, Thermo Electric Company of Saddle Brook, New Jersey and Tech Wire & Cable Company of Newark, New Jersey.

Draganchuk is a graduate of the Newark College of Engineering and is a member of the Instrument Society of America, Temperature Measurement Society, Chemical Engineering Society, and the American Management Association.

Vice President of Sales

The appointment of Jonathan Smith as vice president of sales of Sunbeam Equipment Corporation, Meadville, Pennsylvania, manufacturer of industrial heat treating furnaces has been announced by Vincent R. Troglione, President.

Jonathan Smith

Smith was formerly project manager and his promotion is seen by industry observers as another step in the company's continuing program of increased service to the industry.

Joins Pacific Scientific

Pacific Scientific Company, Los Angeles, has named Robert A. Inabinette to its Los Angeles Industrial divisions sales department.

Inabinette was formerly with Ryan Electronics in San Diego. He is president of the San Diego Chapter of I.E.S. and was program chairman of the San Diego Chapter of I.S.A.

The addition of Inabinette to the Pacific Scientific sales department gives added impetus to this California based firm's continuing and growing program of sales and service.

NEWS TO HEAT TREATERS...

To New Quarters

W. K. Hile Company, Inc., heat treating equipment engineers who represent Stanwood Corporation, have moved to new offices at North John Street, Matthews, North Carolina.

For further information circle No. 9

"Star Sixties"

New Eclipse "Star Sixties" Series B Vari-Port Mixers that accurately proportion gas and air and deliver the mixture under pressure to one or more burners are available from Eclipse Fuel Engineering Company, Rockford, Illinois. A wide range of adjustment is said to permit setting for constant ratio operation with oxidizing, reducing, or neutral flame, depending upon requirements.

The new fan-type mixers are comprised of an adjustable ratio valve mounted on the inlet of an Eclipse steel centrifugal blower. Current Vari-Port Mixers are available in a capacity range of 170,000 to 2,100,000 Btu's/hr. Models yet to be released will cover larger and smaller capacity ranges.

Series B mixers are available in either manually or automatically controlled models. The automatically controlled units can be furnished complete with control motor or, if preferred, with motor mounting or bracket and linkage to fit the customer's control motor.

Features of the new mixer include a multiple setscrew adjustment of gas low to permit air/gas ratio to be accurately adjusted as desired throughout the mixer's range of operation and a four-position adjustable mixture outlet, which is adjusted at the factory when the mixer is ordered.

For further information circle No. 10

West Introduces New Digital Point Controllers

Even closer accuracy in temperature of other millivolt source control are reported possible by the new line of digital set point controllers, introduced by West Instrument Corporation.

By adjusting the 3 digit, 1,000 part dial, the control point can be set in increments as small as one half degree. Full balance circuit provides greater measurement sensitivity, better than ¼ of one degree with most thermocouples.

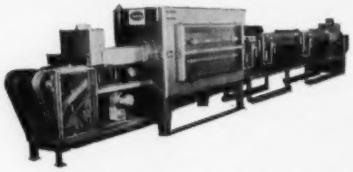
The new Model JY series is available in single, dual or triple range models for temperature or millivolt calibration. Calibration is not affected by leadwire length. Continuous electric cold junction compensation is provided. Response time adjustment is included to adjust the instrument for varying control problems.

Repeatability, linearity and resolution are said to be excellent. The entire unit is compact for panel or surface mounting and is available in on-off, proportioning and stepless control modes. All are tubeless, solid state controllers.

For further information circle No. 11

Conveyor Muffle Furnace

Shown here is the new Sunbeam conveyor muffle furnace which is being introduced by Sunbeam Equipment Corporation, Meadville, Pennsylvania.



This electrically heated furnace can be used for atmosphere controlled continuous copper brazing, annealing or bright hardening of stainless steel parts.

Because of the alloy muffle, the furnace is ready to operate as soon as operating temperature is reached —even after weekend shutdown. Special radiation shields at each end of the heating chamber reduce radiant heat loss. Water consumption is minimized from thermostatic controls in the cooling chamber.

The unit is avaibable in five sizes and has production ranges from 30 to 180 pounds of work per hour. Maximum operating temperature is 2100 F.

For further information circle No. 12

Corrosion Resistant Steel

A new and even more corrosion resistant stainless steel has been developed by Allegheny Ludlum Steel Corporation after two years of in-

tensive development work. It is expected that the new alloy will be used initially in the automotive industry for which it was developed.

The new alloy is called type 433 and has additions of molybdenum and copper to the automotive standard stainless steel of type 430. Patents have been applied for on this new grade.

With this announcement of 433, it brings to three the major developments Allegheny Ludlum has made within the past four months of either new materials or processes for use in the automotive industry.

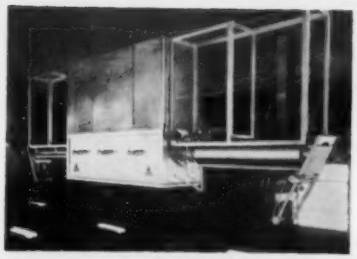
The big advantage of the new product is the added corrosion resistance. Corrosion resistance has become an ever increasing problem to the automotive manufacturers because of the additional use of salt and other road de-icing and road-clearing materials. Many more municipalities across the country are using these metal-eating chemicals and materials; and highway departments are using more of these materials. It was because of this problem that Allegheny Ludlum accentuated its research and development programs a number of years back. The steel firm wished to develop an even greater corrosion resistant stainless steel, but without increasing the price of the metal.

The automotive industry subjects stainless steel to some of the most severe tests. Among these tests are the Cass test, the crevice tests, the salt spray test, the salt slag alternate immersion test, and service tests. Allegheny Ludlum's new stainless steel — Type 433 — passed all of these tests unusually well. The service tests by automotive producers are still continuing, and final reports on these will not be in for six to eight more months.

For further information circle No. 13

5000 F. Research Furnace

Firms doing research work calling for ultra high temperatures will find this new 5000 F. carbon resistor type electric tube furnace, recently announced by The Pereny



Equipment Company, Inc., Columbus, of special interest.

This unit, identified as Model CT-660, is shown here being used by one of the country's leading research laboratories in their rocket materials research and test program.

Having a 6 in. I.D. by 60 in. loading area, it has a full heated length of 60 in. and an even temperature zone of 36 in. The unit is capable of reaching the full 5000 F. temperature in approximately two hours.

Power terminals are water cooled and completely protected with fail-safe electrical interlocks. The entire furnace is automatically shut down in the event of water-flow failure.

For further information circle No. 14

Continued on next page

NEWS TO HEAT TREATERS

Detroit Metal Show Technical Sessions

A record number of ten American technical societies and trade associations, with a combined membership of more than 100,000 will present 62 half day technical sessions at the Detroit Metal Show in participation with the sponsoring American Society for Metals, October 23-27. The technical program will run concurrently with presentation of ASM's educational exhibit on materials and materials processing at Cobo Hall.

Major part of the technical program will be presented by the ASM, involved in 31 half day sessions, Metallurgical Society of A.I.M.E., 23 sessions; and Society for Nondestructive Testing, 8 sessions.

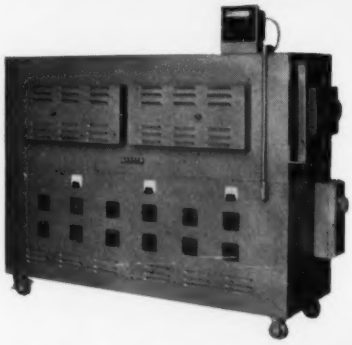
Presenting joint sessions with ASM in addition to AWS and AGA are Industrial Heating Equipment Association, Metal Powder Industries Federation, Metal Treating Institute, Special Libraries Association and Ultrasonic Manufacturers Association.

For the first time, exhibits and technical sessions of all except A.I.M.E. will take place under one roof.

For further information circle No. 16

Tube Furnaces for Zone Control

Tube furnaces designed for zone control to 2822 F. are now available from Harrop Precision Furnace Company. These nonmetallic resistor units can be equipped with tubes made of silicon carbide or



alumina, in sizes up to a practical 8 in. in diameter and 72 in. in length. Silicon carbide tubes themselves, up to two in. I.D., can serve as the resistor. Doors are provided at both ends, and tubes are readily removable for replacement or changing to other diameters.

Harrop tube furnaces are reported to be particularly adapted to the firing of bar stock material and for gradient applications.

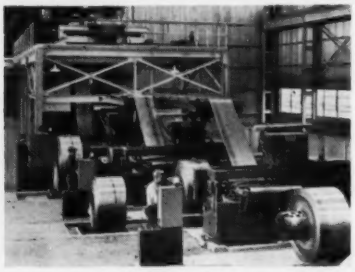
For further information circle No. 18

New Facility Unveiled

The first photographs showing operations at its new facility at Bagdad, Pennsylvania have been released by Allegheny Ludlum Steel Corporation.

The plant, with 160,000 sq. ft. under roof, is a department of the Company's West Leechburg Works. It is located on a 90 acre site across the Kiski River from the West Leechburg Works. The Bagdad department processes high grade, grain-oriented silicon electrical steel strip.

Merle J. Graham, Vice President in Charge of Production at Allegheny Ludlum, announced that a 1,040 foot continuous normalizing line shown here, has successfully passed its trial runs, which began late in 1960, and is now in commercial production.



The new line, which probably is the largest normalizer in the silicon electrical steel industry, substantially increases Allegheny Ludlum's capacity for normalizing silicon electrical steel. In addition, it improves product quality and production efficiency. It also frees considerable plant space and equipment at West Leechburg Works, which was formerly used in processing silicon, but can now be made available for processing stainless steel strip.

Built by The Electric Furnace Company, Salem, Ohio, the new line will normalize silicon strip from .010 in. to .030 in. in thickness and up to 34 in. in width, at speeds up to 300 ft. per minute.

For further information circle No. 19

New Hardening Technique

Enclosure collars used as bearing retainers for railroad car axles are quickly hardened, drawn and quenched, utilizing a new technique and accessory equipment designed and manufactured by Induction Heating Corporation, Brooklyn, New York. The single machine set-up will handle seven different sizes of these railroad axle end caps, ranging from seven inches to ten inches I. D.

The hardness pattern required on the Pearlitic malleable iron collars requires hardening one end around the periphery only 1/16 in. from the face down, and 3/16 in. across the face itself. Hardness required after draw, automatically attained, is RC 45-50.

With this simply engineered set-up, parts are processed in the following manner:

First, the operator places the proper adapter on the rotating spindle used for the desired part.

Second, he selects one of the Ther-Monic patented insert coils and simply fastens it to the master coil with the six screws provided.

Third, he sets the Multiflex timer for the heating and quenching cycle. Average range for the seven sizes is: heating time—30 to 45 seconds; quenching time—1.5 seconds. The reserve heat left in the part draws the part down from RC 60 to the 45-50 RC required.

In short, the operator simply places parts on the spindle, de-

Continued on next page

presses the "start" cycle button, and from that point on, all operations are completely automatic.

The adapters are water cooled. By this technique, heat cannot build up in the adapter itself, which conceivably could change the heat pattern laid down on subsequent pieces.

For further information circle No. 20

Constant Control Unit

A new transistorized, constant phase control unit providing exact, microsecond regulation of power output and operating temperatures of electric furnaces and other heat or power regulating systems, and a new cold wall vacuum furnace consolidating full size components into an attractive, space saving cubicle are marketed by C. I. Hayes, Inc., of Cranston, Rhode Island.

The new Hayes control is called the pHayes-master (TM) Power Amplifier Control Unit. It uses silicon control rectifiers and other semi-conductor devices as a means of varying voltage to control temperatures of electric furnaces, and equivalent applications where exact, instantaneous control of power output is needed. Seven in. by nine in. by three in. in size, the pHayes-master unit replaces bulky and costly components, vacuum tubes, magamps, reactors, powerstats, and other space-taking equipment, and effects a savings in space of up to

75%. It also features a higher power factor for more efficient, economical operation. Because of its small size, simplicity, and minimum number of components, pHayes-master is reported to be far easier to install and maintain.

For further information circle No. 23

Wide Range Tester

Cincinnati Sub-Zero Products has announced the availability of a new unit for testing wire and cable under temperature conditions from plus 80 to minus 100 F. ±2 F. The pulldown is accomplished in sixty

minutes. The machine has been designated model WU-100-24.

The specially designed chamber, measuring 24 in. wide, 26 in. deep, and 72 in. high, is penetrated by a self supporting cone-step mandrell which provides for testing on two in., three in., four and one-half in. and six in. diameters. It may be used on the side, or the back wall of the chamber, and the rugged pillow-block construction will accommondate a test load of 1/2 ton.

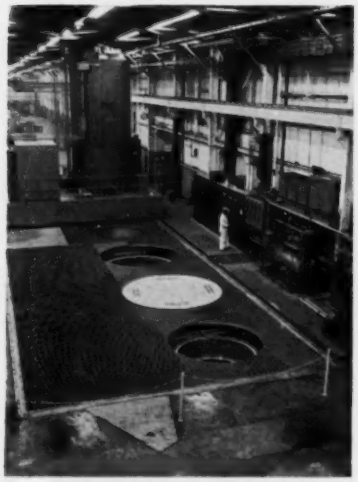
Two ports, 12 in. by 12 in. frost free multipane window, and interior illumination, complete the appointments. The chamber incorporates a specially ducted fin coil evaporator on the rear wall which allows unencumbered use of the entire test area.

The power pack operates on current requirements of 230 volt, 60 cycle, 1 phase. The overall dimensions are 34 in. wide by 36 in. deep by 86 in. high.

For further information circle No. 24

New Treating Facility

Twin gantry furnaces and 10 pit stations are outstanding characteristics of a new heat treating facility recently placed in operation by



Douglas Aircraft Company, Torrance, California.

Purpose of the facility is to provide ideal conditions for the heat treatment of very large parts. Items up to six ft. in diameter and 18 ft. long can be treated at this installation.

Each gantry is electrically heated and can produce a maximal temperature of 2,000 F. with 416 kilowatts of power.

Stations in the pit, which is 30 ft. deep, are for six draw furnaces, two atmosphere quench units, and two oil quench units. In addition, the facility has two endothermic generators, two exothermic generators, and numerous accessory equipment.

Each oil quench tank holds 6,350 gallons of fluid, which is recirculated at the rate of 5,000 g.p.m. with two 20 hp. pumps, and has a maximal operating temperature of 200 F. The latter temperature is maintained by a pair of heat exchangers, one of which uses steam to heat the oil while the other uses water to cool the oil whenever necessary. Oil is circulated through the heat exchangers at the rate of 200 g.p.m.

All pit stations are accessible to either gantry furnace, which can be moved to any point on 157 feet of track.

For further information circle No. 26

Continued on next page

NEWS TO HEAT TREATERS

Quality Standards Updated

A major upgrading of manufacturing standards for production of mounted abrasive wheels has been completed by Bay State Abrasive Products Company, Westboro, Massachusetts.

According to Fred C. Stockinger, Bay State sales manager, "The upgrading of standards was intended to keep the company's products ahead of competition. For example,

Bay State pretests every single wheel under overload conditions to assure the security of the spindle mounting."

Along with its new higher standards, Bay State has available a 30 page illustrated catalog which greatly simplifies customer specifications and ordering methods. More than 10,000,000 combinations of grit, size, bond, porosity, spindle size and other features are possible to meet customer problems, Stockinger said. Stock availability is included in the catalog.

For further information circle No. 29

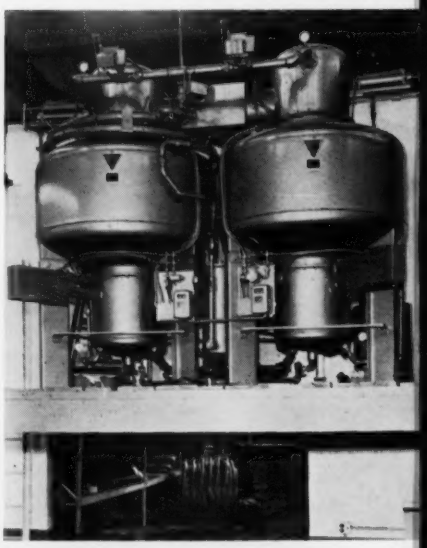
New Vapor Solvent Recovery System Available

A completely new, patented process for the recovery of usable solvent from vapors usually lost during degreasing and cleaning operations, has been announced by the Industrial Division of Vic Manufacturing Company of Minneapolis.

This unique installation (see cut) of a Vic Vapor Recovery System at Superior Plating Company, utilizes an overhead platform with no sacrifice of working areas.

Thoroughly field tested on actual installations over a period of three years, Vic's new line of Industrial Vapor Absorbers is reported to have cut solvent costs by more than 50%, and to have solved a health problem as well, by removing undesirable solvent vapors from the atmosphere of adjacent working areas.

The loss of solvent through evaporation of vapors has long been a problem in the metals field. Not only has there been a substantial expense to firms using solvent, but there have been undesirable side effects which have caused finishing problems. In some cases, where ventilation is inadequate, solvent vapors have caused corrosion on the surfaces of manufactured and finished metal parts. Vapors have also affected painting operations, sometimes causing cloudy or uneven paint finishes. Until now, the only



solution to the control of escaping vapor, has been to increase ventilation and exhaust, which naturally increased the evaporation of solvent, and increased operating costs.

Designed specifically to solve these problems, Vic's Vapor Recovery System captures solvent

Continued on page 36

Safeguarding Nichrome Brazing In Hydrogen

Concluded from page 19

outdoor venting can hardly be justified. Thus, it becomes practical to burn the off-gassing product at a point convenient to the furnace. With the brazing chamber housed in the electric furnace, the two copper lines are brought out through a slit below the incompletely closed balanced door. The waste gas line can be led to some point above the furnace where drafts are not a flame-out hazard.

A safety device for the prevention of flame-outs and lighting off the gas automatically is easily arranged. The flame can be impinged on an electrically heated filament—maintained at near incandescent temperatures—with passage of 115 volt alternating current controlled by a simple resistant device consisting of a 150 watt lamp wired in series with the heated filament. The burning lamp is an ever-present indicator, assuring technicians that burning-off functions are uninterrupted insofar as automatic features are involved.

The best service is obtained when hydrogen purchased meets specifications requiring minimum permissible water and oxygen content. Medical grade hydrogen is recommended. Contaminants can be further reduced by filtering through a desiccant and an electro-dryer, then making passage through an ample sized cold trap loaded with dry ice. ● ● ●

"MR. GAFFNY! - YOUR HAND IS LIKE ICE!"

NEWS TO HEAT TREATERS

Continued from page 34

vapors evaporating during degreasing and cleaning operations, by ducting them into a specially designed tank with a bed of activated carbon, returning clear, reusable solvent after a steaming and decantering process. Vic engineers have had the reclaimed solvent thoroughly tested by the original solvent manufacturer, and report that in all cases the solvent has been certified as "perfect for reuse."

Vic Vapor Recovery Systems are available in 11 different automatic and manual models, designed for compact installation with a minimum loss of valuable manufacturing space. Should a particular installation require specialized engineering or electrical characteristics, the manufacturer states that it is possible to build variations of the standard systems to meet specialized requirements.

For further information circle No. 30

Norton Super Hot Rod

An improved nonmetallic silicon carbide-molybdenum disilicide heating element, known as Super Hot Rod, has been developed by Norton Company for use in kilns and furnaces up to 1700 C.

Company tests show that not only does this new element have longer life at the normal maximum operating temperatures of conventional silicon carbide heating elements (about 1500 C.), but it raises the maximum operating temperatures about 15% without losing its long life properties. This long life is achieved because of the excellent oxidation resistance of this material.

Super Hot Rods are reported to combine the best properties of silicon carbide and molybdenum disilicide, both well recognized materials for high temperature work. The physical appearance of Super Hot Rods is markedly different from conventional rods. The new rod is tubular in form. The hot zone is formed by a spiral cut completely through the wall of the tube. Exact hot zone length and closely controlled resistivity is obtained by using a precalculated spiral angle.

Present users of the standard silicon carbide heating elements will be able to use Super Hot Rods with existing power supplies. Some additional capacity may be required to obtain the higher operating temperatures if present equipment is already at capacity.

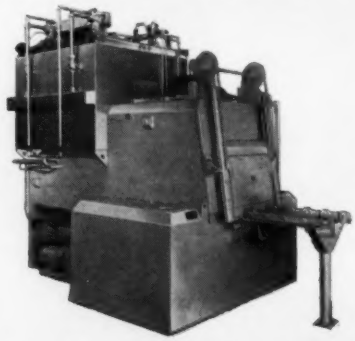
This new element can be operated up to 1700 C. without requiring a protective atmosphere. It also can be used in special atmospheres where the present silicon carbide elements are being used.

Because of its high temperature strength the Super Hot Rods may be installed horizontally. They can be used vertically as well.

For further information circle No. 34

Additions to Johnston Manufacturing Line

Johnston Manufacturing Company, Minneapolis, Minnesota, has added controlled atmosphere fur-



naces to its line. The new furnaces are designed for completely auto-

matic operation. Transfer is by a high speed, roller-chain system which operates completely out of the heat to eliminate heat caused maintenance problems.

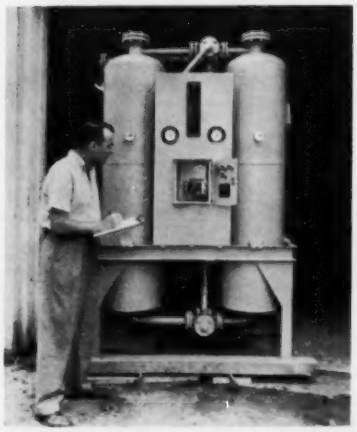
First movement is from loading vestibule to bottom-charged, sealed heating chamber. Four cast alloy, gas-fired, U-type radiant tubes with proportioning type controls bring the chamber up to temperature and hold as required. Radiant tubes, muffle, and recirculating fan are incorporated in chamber design so that 100% of the chamber gases are forced outside of the muffle, around the U-tubes and pulled up through the charge. The water-cooled, two-speed, recirculating fan, automatically shifts to show speed at high temperature.

Recirculation of quench oil is by centrifugal pump and jets. A valve controls volume of oil flow from minimum to maximum. Separate oil chiller and cooler with filter is recommended. Automatic controls for maintaining oil temperature are furnished. A second charge can be cycled while the first is quenching.

For further information circle No. 35

Gas Dehydrating Unit

A new dehydrating unit, incorporating Rockwell-Nordstrom four-way lubricated plug valve, which provides complete, continuous,



moisture removal, has been announced by Gas Drying, Inc. of Chatham, New Jersey. Named De-

Continued on next page

hyditrol, the unit is self-contained for completely dehydrating compressed gases.

For further information circle No. 36

"Handi-Blast" Sandblaster

A completely new "Handi-Blast" Portable Sandblaster has been introduced by the Handi-Blast Division of Hamill Manufacturing Company, Inc. of Washington, Michigan. Designated model 28A, the unit

has been designed for use wherever the need for fast, economical sandblasting is required at low cost.

The new Model 28A is constructed of 1/8 in. steel and is completely portable. It is 29 in. high with a tank diameter of 6 in. Unit weight is 24 pounds empty with an abrasive capacity of 28 pounds sand. Each sandblaster is tested for 300 P.S.I. and effectively operates on the same air hook-up as any production spray gun. The carrying handle enables the unit to be easily carried from one location to another.

The portable sandblaster features a unique squeeze grip abrasive delivery nozzle which allows the operator to control and shut off the flow of abrasive at will. A pressure gauge and pressure relief valve are also standard equipment on the unit, to render it completely safe and to

comply with state and city regulations where required. The unit has a number of other distinctive features which make it a valuable tool for any plant or shop where blasting equipment is needed.

For further information circle No. 39

Tufftride Process

A liquid nitriding process known as Tufftride, developed in Germany and proven in automotive and industrial tests and production applications, has been formally announced by Kolene Corporation of Detroit.

The Tufftride process develops a tough, ductile, wear-resistant surface and increases fatigue strength of various steels and cast irons without a brittle white layer.

Tufftriding is being applied to low carbon, alloy, stainless, tool, and heat-resistant steels, as well as, grey, alloy, nodular or ductile, malleable, and pearlitic irons.

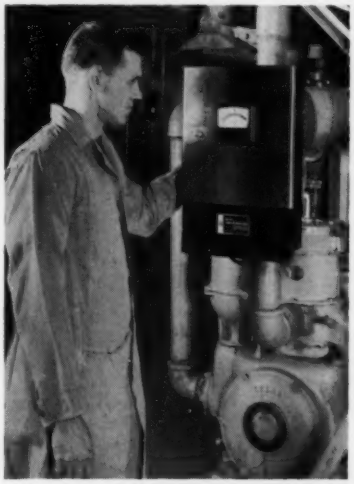
Besides producing a non-brittle, tough, wear-resistant surface, it has remarkable anti-galling and anti-seizing properties even when run without lubrication. Distortion and growth after Tufftriding of finished and ground parts is negligible, if there are no residual stresses prior to treating.

Fatigue life of the metal is very appreciably increased; on low carbon steels, up to 80%; medium-carbon steels, 60%; 18-8 type stainless steels, 35%; grey cast iron, 20%; and on malleable iron, 43%.

For further information circle No. 40

Selas Qual-O-Rimeter

The Qual-O-Rimeter Combustion Indicator, a new instrument which accurately indicates changes in flame characteristics caused by variations in gas fuel supply and air/gas mixture, has been announced by Selas Corporation.



Reported to be compact, easy to install and operate, this continuous reading device fills a need for industrial heating operations where the heat transfer rate must be maintained to meet exacting time-temperature cycles.

Sensitive to any variation, the Qual-O-Rimeter detects and indicates changes as little as five Btu in fuel gas and ±0.5% air in air/gas mixture, in five seconds. Similarly, changes in flame configuration are quickly indicated.

Functioning by presampling air/gas mixture, the Qual-O-Rimeter permits proper adjustment of ratio before production is adversely affected.

Changes in air/gas ratio, Btu content of fuel gas, flame geometry, and combustibles atmosphere can be compensated for with the aid of the Qual-O-Rimeter.

For further information circle No. 41

Continued on page 43

Application of a new Cobalt-Base Alloy in Metallurgical Furnaces

TEN YEARS AGO, *engineers in a large manufacturing operation in the Congo developed an alloy which recently was labeled UMCo 50. This alloy is relatively machinable for a durable metal and to date, two UMC grades have been developed. The low-carbon grade, with less than 0.1% C, for use in applications requiring good mechanical properties either at elevated temperatures or in corrosive media; and the high-carbon grade, containing 1 to 2% C, when high abrasion resistance is necessary.*

Fabrication and properties of low-carbon UMCo 50

The development work was done at the Union Minière du Haut-Katanga Central Workshops where low carbon UMCo 50 is obtained by melting cobalt granules and low-carbon ferrochromium under a lime slag in a magnesia-lined induction furnace. Due to the high purity of the raw materials, no further refining is necessary. Pouring is carried out at about 1600 C. after deoxidation in the ladle by means of silico-calcium. There are no significant casting difficulties, the thermal expansion of UMCo 50 being of the same order as that of austenitic steels.

Nominal composition ranges are: Co 47 - 52%, Cr 26 - 29%, C 0.04 - 0.08%, S 0.01 - 0.03%, balance iron and addition elements, deoxidizers, etc. (Mo, Ti, Cb, etc.).

Initially, additions of molybdenum of up to 3% were made systematically in view of stabilizing the carbides and improving corrosion and oxidation resistance at elevated temperature. Thereafter, the detrimental effect of Mo on the toughness and forgeability of the low-carbon grade was detected and these additions were progressively abandoned in most of the applications.

The principal properties of low-carbon UMCo 50 are listed in Table I. The alloy possesses exceptionally high hardness for a machinable material. Its hardness of 280 Bhn at room temperature is still about 130 Bhn at 800 C. Practical tests have proved that its oxidation resistance in air and its mechanical strength up to 1300 C. are far superior to those of the original materials it has replaced. Its coefficient of expansion is relatively high, but on the other hand, the alloy has no transformation points and is, therefore, relatively free from temperature-induced deformation.

Forging is carried out at temperatures between 850 and 1100 C. and requires no special precautions provided that the S content (corrected if necessary by adding Mn) is low, that the carbide-forming elements (C, Ti, Cb, W, Mo, etc.) are incorporated in controlled amounts, and that the melt is completely deoxidized before pouring (through an addition of 0.5% aluminum and 1% silico-calcium).

TABLE I. — PROPERTIES OF LOW-CARBON UMCo 50

Physical Properties		
Density	7.9 to 8.1 kg/dm³	
Coefficient of thermal expansion	16 to 17 · 10⁻⁶/°C	
Thermal conductivity	0.0213 cal/cm² sec °C	
Electrical resistivity	80.6 to 81.2 × 10⁶ ohm/cm	
Mechanical Properties		
	As-cast (0.11 % C)	As-worked (0.04 % C)
Tensile strength	90 kg/mm²	94 to 100 kg/mm²
Elastic limit	68 kg/mm²	43 to 48 kg/mm²
Room temperature hardness	250 to 275 Bhn (according to Mo content)	270 to 280 Bhn
Toughness : Steven test*	11 kg m/cm²	20 to 23 kg m/cm²
(with 2.38 % Mo)	5 kg m/cm²	—

* STEVEN : " Impact test for evaluating tool steels ", *Metal Progress*, May 1959, p. 79.

Low-carbon UMCo 50 is difficult to machine because of its high susceptibility to strain-hardening. Annealing at 1150 C. followed by slow furnace cooling improves the machinability and even allows tapping.

Heat Treating Furnace

In one of the Jadotville Central Workshops heat-treating furnaces at Union Miniere du Haut-Katanga (Congo), low carbon UMCo 50 has been used to make the metallic shield which protects the refractory bricks in which the heating resistances of the sole are embedded. The sole is 4.2 m. x 3 m. in area, and the shield is made of 645 interlocking parts. These are submitted to an oxidizing atmosphere at a temperature of about 900 C. The initial shield material was a 30%-Cr ferritic steel which did not resist the mechanical shocks incurred in handling heavy parts. In addition, and in

Concluded on page 45

MANUFACTURERS' LITERATURE

For your copy circle the number on the Readers' Service Card

Bulletin Q-2 from Selas Corporation, Dresher, Pennsylvania, describes the Qual-O-Rimeter Combustion Indicator, a continuous reading instrument which accurately indicates changes in flame characteristics caused by variations in air/gas mixture. Typical uses illustrated include brazing and soldering, heating for hot working, setting up multiple air/gas mixing machines and glass fiberizing. Eleven other potential applications are outlined. Specifications and operation are completely detailed, including performance curves, a schematic diagram, and an internal photograph with the nomenclature called out.

For further information circle No. 43

Bulletin GED-4304 describes General Electric's gas or electric roller hearth furnaces for high production, top quality, economical annealing, hardening, brazing, sintering and general heat treating. Four pages of drawings and copy explain design features of various components of the furnaces. Different types of heating chambers are also discussed. Diagrams show furnaces most suitable for each treating process. A specifications chart gives application data.

For further information circle No. 44

Wheelabrator Worldwide is the title of a new 16 page brochure that pictorially describes the export facilities and worldwide operations Wheelabrator Corporation has developed to meet the growing needs of industry for metal cleaning and finishing equipment and dust and fume control equipment. This brochure will be especially helpful to United States manufacturers with overseas operations because it describes distinctive Wheelabrator services and equipment designed to assist such manufacturers in setting up effective and economical metal cleaning or finishing departments, and in providing for efficient dust and fume control.

A large number of the overseas installations of Wheelabrator airless blast cleaning equipment and Dustube dust and fume control equipment are pictured to depict the various types of such equipment in use throughout the world.

For further information circle No. 45

Bulletin D-61, titled "Controlled Atmosphere Tempering Units," has been published by Ipsen Industries, Inc., Rockford, Illinois. The bulletin describes furnaces used for atmosphere tempering, annealing, and stress relieving. The Ipsen DFC-4-600 Tempering Furnace is illustrated, and a cross section diagram explains the details of the DU-4-600 Atmosphere Tempering Unit. The latter includes an insulated quench tank in addition to the two-zone atmosphere cooling chamber. Exclusive features of these units are described along with specifications of dimensions, maximum heat input, net heating rate, and maximum load at 1500 F.

For further information circle No. 46

Volume 12, Number 1, of *Heat Treat Review*, published by Surface Combustion Corp., contains an interesting article on safety standards for heat treating equipment, which outlines the responsibility of equipment users, furnace manufacturers and insurance associations. Other articles cover a discussion of bell type coil annealing furnaces which utilize power convection and a case history of a commercial heat treater who could not expand his plant because of land shortage but found a way to double his production.

For further information circle No. 47

Five Heavy Duty Rotoblast Barrels, with work capacities ranging from 15 to 102 cu. ft., are described in Bulletin No. 705 published by Pangborn Corporation, Hagerstown, Maryland. The features which make Rotoblast one of the most powerful blast cleaning processes available today are illustrated with cut-away drawings, photos and sketches. Specifications and overall dimensions are also outlined. Illustrated case histories show heavy-duty Rotoblast barrels have reduced costs substantially at many different installations.

For further information circle No. 48

A New 56 Page Catalog which covers the complete line of ElectroniK controllers, pneumatic and electric is available from the manufacturer, Minneapolis-Honeywell Regulator Company. This detailed, highly illustrated catalog covers new modular design features as well as the new proportional plus reset plus rate control units, partial chart listings, and pneumatic and electric contact control forms.

For further information circle No. 49

Continued on page 42

MANUFACTURERS' LITERATURE

Heating Furnace Chain Curtains is a descriptive booklet on furnace chain curtains for use in heat treating operations. The booklet, available from E. J. Codd Company, Baltimore, illustrates and describes the operation and advantages of these items.

For further information circle No. 51

Data Sheet 18 covers Heppenstall T79, a 5% chromium type hot work steel to which 4% tungsten is added to improve high temperature and heat resistant properties. Typical applications are in aluminum die casting dies, brass extrusion dies, and components.

For further information circle No. 52

A New Eight Page Specification outlines features, specifications and ordering information on Honeywell's new pneumatic temperature transmitter which uses a filled thermal system and transmits a standard 3-15 psi signal which varies in proportion to changes in the measure temperature. Complete specifications on gas and mercury filled systems available with transmitter are included in the sheet.

For further information circle No. 53

Metals Engineering Extension Diploma is a six page folder available from the American Society for Metals. The brochure describes the new Metals Engineering Institute Extension Diploma, granted for completing sequence of five home study courses in the following subject areas: ferrous metallurgy, welding metallurgy, nonferrous metallurgy or metallurgical processes. Diploma requirements may be met through correspondence, ASM Chapter and in-plant training classes. Twenty-one courses on engineering aspects of metal-working materials and processes are currently offered by the Society, plus a number of composite courses custom tailored to needs of the individual.

For further information circle No. 54

Material Processing is a four page folder which deals with stabilization of steel, stress relief of aluminum castings, and product improvements such as rubber bushings, transistor cycling, and improved magnetic qualities in steel. The data is published by Cincinnati Sub-Zero Products.

For further information circle No. 55

Bulletin No. 1960 titled Blue M Power-O-Matic 60 Mechanical Convection Ovens with Blue M Saturable Power Reactor Control is available from Blue M Electric Company, Blue Island, Illinois. The bulletin illustrates and describes Blue M's new line of Mechanical Convection Ovens, such as laboratory production ovens, aging ovens, miniature batch ovens, hazard-safe ovens, five drawer ovens, testonic environmental cabinets, incubators, sterilizers, gravity ovens, conditioning cabinets, refrigerated baths, as well as a detailed explanation of the new Power-O-Matic 60 Control System.

For further information circle No. 56

Bulletin 103-T, is now available from Trent, Inc., Philadelphia. The bulletin describes in detail Trent's new series of Folded and Formed industrial electric heating units for furnaces, ovens and dryers. Included are sections on application, performance, dimensional specifications, and installation, as well as numerous charts and tables.

For further information circle No. 57

A Six Page, Fully Illustrated Bulletin which covers the applications of vertical and horizontal equipment for processing continuous strip is available from Surface Combustion Company. Heat treatments discussed are for ferrous and also nonferrous strip metals, and involve annealing, normalizing and galvanizing processes. The many facets of processing strip metal illustrated include mechanical handling and feeding equipment, line drive machinery, electric line drives, tension control, roll design and a number of others

For further information circle No. 58

Bulletin No. H-1 issued by the Combustion Division of Eclipse Fuel Engineering Company, Rockford, Illinois, presents eight atmospheric gas-fired burners with maximum firing capacities from 10,000 to 2,750,000 Btu/hr. The bulletin provides dimensions, specifications, engineering data, and ordering information for pipe, wheel, immersion, ring, box, and "U"-type burners, atmospheric injectors, and packaged burners. Burner accessories include gap-type burner nozzles, mounting cages, and a draft-compensating pilot. An introduction to the operating principle of atmospheric burners, instructions for building atmospheric combustion systems, and an illustrated description of six typical burner installations also are included.

For further information circle No. 59

A Muti-page Brochure from Harris Manufacturing Company, Cambridge, Massachusetts offers testimonials from leading users of the firm's products. Hardening, stabilizing and shrink-fitting as applied at such business giants as United Air Lines, Chicago Pneumatic Tool Company, and Miniature Precision Bearings, Inc. are but a few of the uses which are discussed. The brochure is liberally illustrated with pictures.

For further information circle No. 60

Profitable Management For Main Street is a booklet which deals with a variety of business problems through selected case histories. The book is available through Dun & Bradstreet, Inc., Public Relations Division, P. O. Box 803, Church Street Station, New York 8, New York.

NEWS TO HEAT TREATERS

Protects Belts in Brazing

Problems common to continuous high temperature brazing have been solved by several firms with ceramic-fiber paper. Called Fiberfrax, this paper is placed on the conveyor belt or fixture under the parts to be processed or is used as a protective wrap for the parts. It prevents deterioration of the belt or fixture, product contamination and expensive delays in setup time.

At the large jet engine department of General Electric in Cincinnati, a continuous hydrogen-atmosphere furnace is used for brazing small buckets, blades and other parts for jet engines at temperatures averaging 1950 F. Before using ceramic-fiber paper, the fluxes melted and attacked the belt. In some cases, parts brazed to the belt itself. The paper prevents these troubles, saves production downtime and replacement of the costly alloy belt.

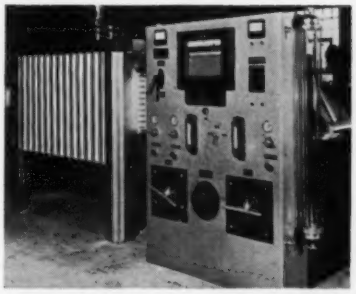
Another company, Kinetics Division, High Vacuum Equipment Corporation, Hingham, Massachusetts has had considerable success with the 970-AH paper in heat treating and vacuum brazing of costly metals such as titanium, zirconium, tantalum and their alloys. This paper prevents these metals from alloying with the stainless steel fixtures and hearth at 2560 F. in the heat treating furnace. Wrapping the work in paper preserves a bright, uncontaminated finish since gases being removed pass readily through the porous paper and recondense on the outer surface during the cooling cycle.

For further information circle No. 61

Continuous Elevated Temperature Operation

Fused stabilized zirconia refractory, a valuable military and industrial research tool since its development by Norton Company in 1951, has recently been placed in service in its first commercial application as a refractory for furnace construction.

A furnace designed to operate continuously at elevated temperatures in the vicinity of 2200 C. has been built by C-M Manufacturing and Machine Company, Bloomfield, New Jersey. The refractory for lining the hot zone is fused stabilized zirconia manufactured by Norton Company. The heating elements are specially selected and machined tungsten rods. The furnace can be operated with hydrogen or other reducing or inert atmospheres compatible with the furnace materials.



The pilot model of this furnace was built to provide a means of sintering large pressed tungsten ingots. Heating the metal for as little as one hour in the hot zone of the furnace has increased the metal density sufficiently to permit hot working to reduce the diameter of the ingot.

This ultra-high temperature furnace has many potential uses in the study and production of special ceramics, cermets and refractory metals.

Zirconia in molded shapes and as loose grain has been widely used in the past ten years in high temperature applications. However, its use has been primarily in research fields, many in the area of government sponsored research into high temperature conditions.

For further information circle No. 62

Automatic Pyrometer

Instrument Development Laboratories, Inc., Attleboro, Massachusetts has introduced the PYRO-650, an optical brightness pyrometer that makes possible continuous recording and controlling of high temperatures in the range from 1200 to over 7000 F.

Rocket and missile engineers are reported to have shown keen interest in this instrument and its use for precise temperature measurement of exotic metals and for temperature measurements in physical property studies relating to optimum rocket and rocket engine performance.

Pyro-650 also has uses in industries such as metals, cement, ceramics, glass, refractory materials, and other industries where operations are carried out at high temperatures. It is of value in those applications where thermocouples or total radiation pyrometers cannot be used.

For further information circle No. 63

Triple Purpose Furnace

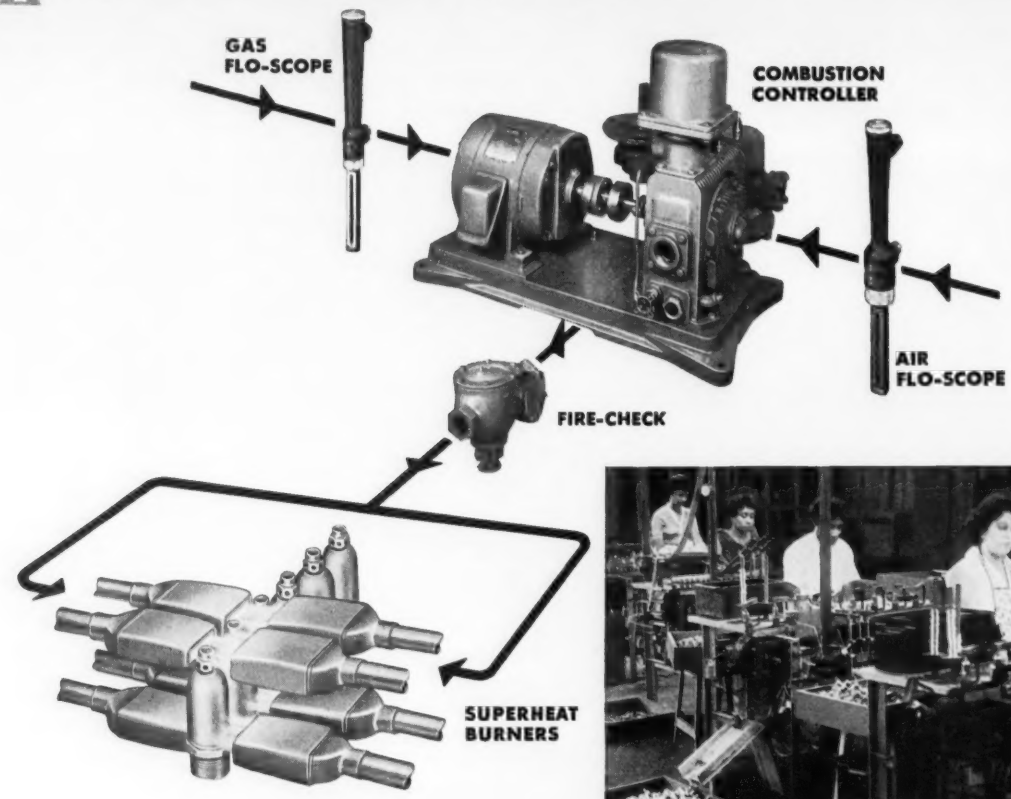
Sunbeam Equipment Corporation has introduced the triple purpose heat treating furnace shown here.

Practically every heat treating operation can be done with this Model TP-D combination triple purpose furnace. Its uses include hardening, forging, welding, tool dressing, annealing, normalizing, pack carburizing and nonferrous metal melting. Its versatility and compact design make it especially adaptable to use in tool rooms, small shops and schools.

The three furnace unit consists of a pot furnace, an oven and a forge.

For further information circle No. 64

NEW SLANTS ON HEAT PROCESSING FROM SELAS



Each of four automatic machines, using Selas combustion components, is capable of brazing 600 air-venting valves per hr. at Flair Manufacturing Co., Brooklyn, N.Y.

Individually–or as a package–Selas combustion tools will improve your heat processing!

Selas combustion components are available individually, or as a complete combustion package, to meet your heat processing needs. The Selas combustion system illustrated above consists of:

- *Superheat Burners*—using only commercial fuel gas and air—with no bottled oxygen—provide fast, localized heating effects. Superheat Burners can be utilized in open arrangements . . . in-line . . . in circular rings . . . in spirals . . . individually . . . in opposed pairs. (Bulletin 56A)
- *Combustion Controller*—by delivering gas-air mixture to burners at preset ratio and pressure, makes possible fast heating and close control. Completely automatic . . . no labor required in its operation. Factory Mutual approved. (Bulletin 56B)
- *Flo-Scopes*®—installed at the inlets to the Combustion Controller, measure rates of flow of gas and air and permit accurate determination of gas-air mixture ratios. (Bulletin 56C)
- *Fire-Check*—gives complete assurance of safety by automatically extinguishing any flashbacks that may occur. Factory Mutual approved. (Bulletin 56D)

Selas also offers other types of burners including DURADIANT®, Refrak, Spearl Flame and Ribbon.

For descriptive literature about any of the above combustion components or information about Selas complete combustion packages, address General Industry Division.

DURADIANT and FLO-SCOPE are registered trademarks of Selas Corp. of America.

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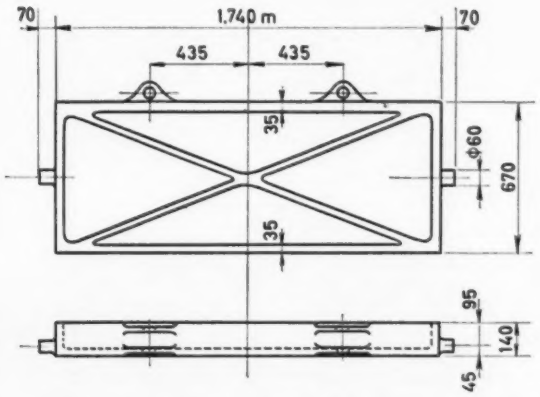
SELAS

HEAT AND FLUID PROCESSING ENGINEERS
DEVELOPMENT/DESIGN/CONSTRUCTION

Application of A New Cobalt-Base Alloy In Metallurgical Furnaces

Concluded from page 40

spite of the special design of the shield, this material was unable to match the appreciable expansion and deformation which the refractory lining underwent on heating, and the steel parts fractured. The original shield remained in service for about 1½ years, during which period the furnace worked much less intensively than now. Notwithstanding this fact, several parts of the shield were flaked or fractured to such an extent that the electrical heating through the sole had to be discontinued in order to avoid short circuits. The UMCo 50 shield, now in service for more than 2 years, has successfully withstood the mechanical and thermal stresses as well as the mechanical shocks. As yet, it does not show any trace of wear.



Compagnie Cuivre et Zinc — UMCo 50 discharge door of billet reheating "walking-beam" furnace.

Quenching Baskets

It was in an attempt to solve the handling problem concerned with the water-quenching of 12 - 14% Mn Hadfield steel parts from 1050 - 1100 C. that the engineers of the Jadotville Central Workshops first developed and used the UMCo 50 alloy. The baskets made of this alloy (see picture) show good resistance to air oxidation at 1200 C. They also possess adequate mechanical strength at this temperature in spite of the wide slots in their sides and the relatively low thickness of their suspension rings (which does not exceed 15 mm. for an overall load of 3000 kg).

The low-carbon UMCo 50 baskets are capable of withstanding 300 to 350 quenching operations. This extraordinary performance is due to the alloy retaining its mechanical and oxidation-resistance properties at high temperature. Before the advent of the UMCo 50 alloy, the baskets, made of plain carbon steel, did not withstand more than three to four quenching operations, mainly because of severe oxidation during the heating periods. Quenching baskets made of nickel-base alloys of the Inconel type, which are often used in such applications, have not been tried at Jadotville, and consequently no comparable data are available. It should be noted, however, that Inconel baskets cost three times more than those made of UMCo 50.

Electrodes for Salt-Bath Furnaces

The Jadotville Central Workshops furnaces for heating high-speed steel use cyanide salts of the Cassel C.S. 700 type for cementation purposes and salts of the Hougton Special 1550 type for quenching or annealing; these are heated to 800 and 1350 C., respectively. The electrodes are 6 cm. x 6 cm. in cross section and 40 cm. long. When made of wrought low-carbon UMCo 50, they have a service life at least three times that of the original 30%-Cr steel electrodes.

Above information presented through the courtesy and cooperation of the "Centre D'Information Du Cobalt", Brussels, Belgium.

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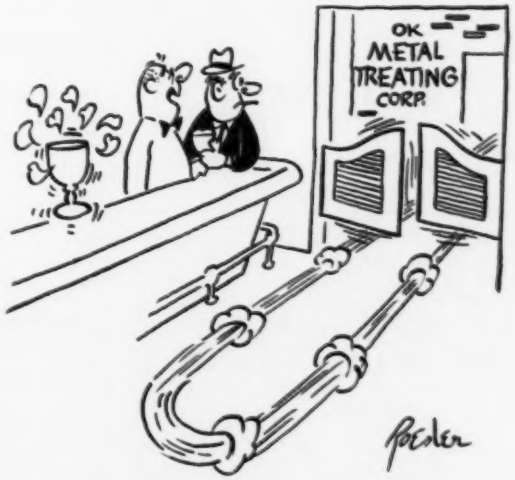

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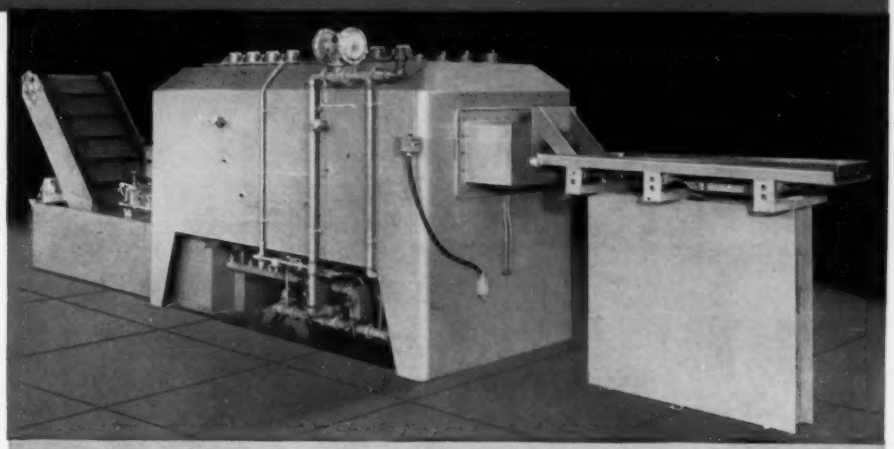

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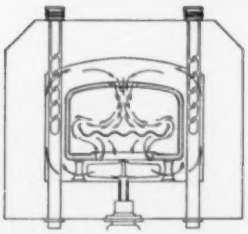

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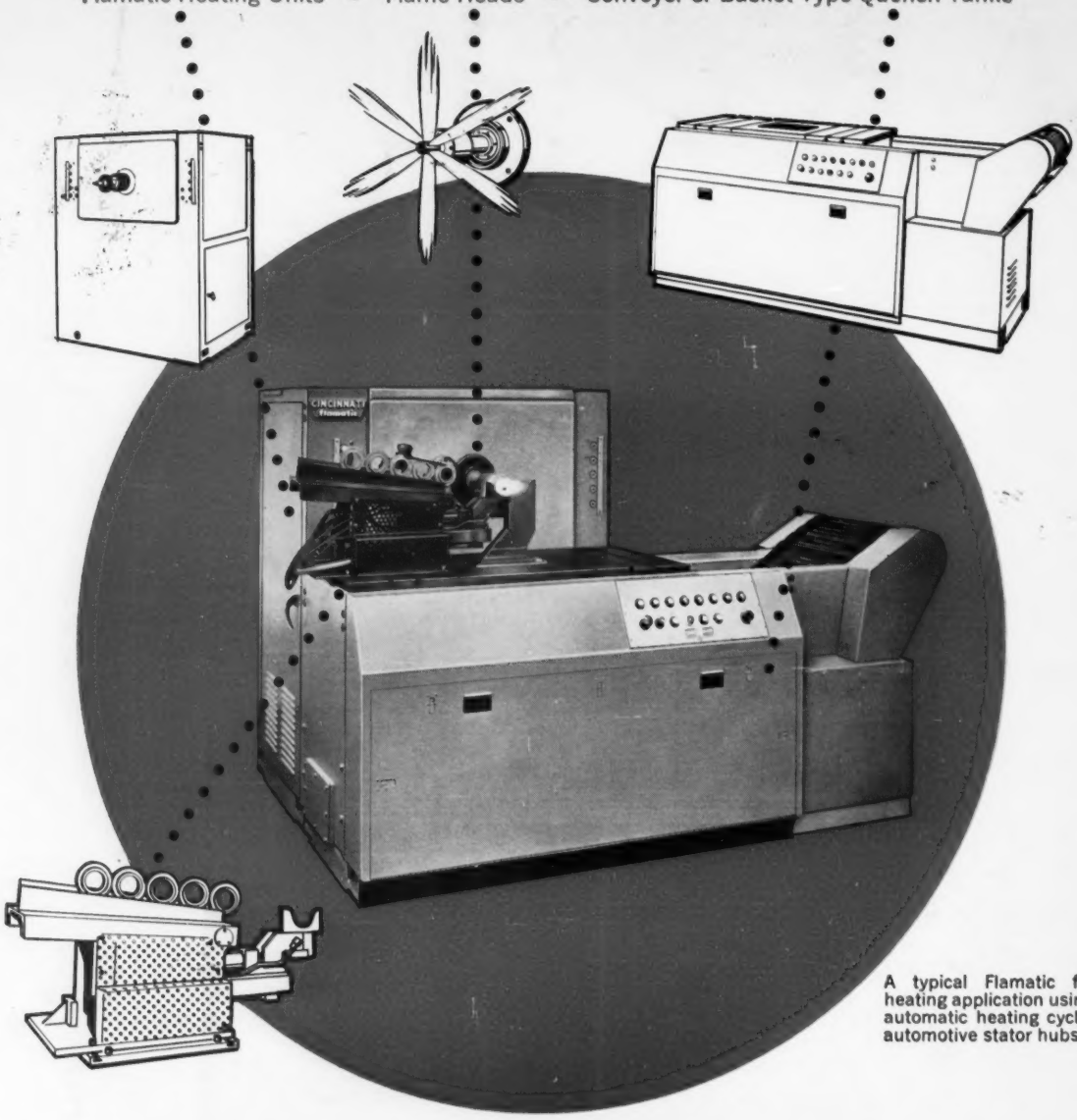

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